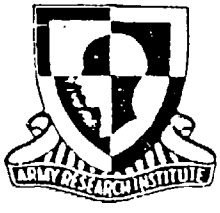

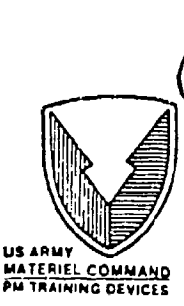

Research Product 89–03

FOG-M System Embedded Training (ET) Demonstration Courseware Outlines

January 1989

Manned Systems Group
Systems Research Laboratory

U.S. Army Research Institute for the Behavioral and Social Sciences

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Embedded training (ET), an integral part of weapon system design, offers a unique training capability. As part of the effort to develop ET for a demonstration FOG-M, this report presents an objectives hierarchy and a courseware outline. In addition, a first draft of the objectives hierarchy required for all training for the fielded FOG-M system is presented.

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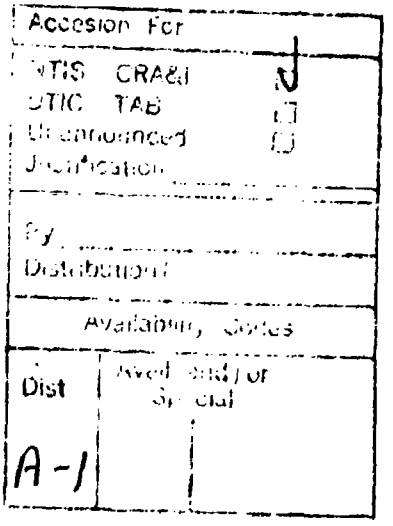

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Research Product 89-03

FOG-M System Embedded Training (ET) Demonstration Courseware Outlines

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Human Performance
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and Simulation

FOREWORD

This report contains outlines for embedded courseware to train personnel in the operation of the Fiber-Optic Guided Missile (FOG-M), a concept being explored by the Army Missile Command (MICOM). The Army Research Institute for the Behavioral and Social Sciences (ARI) has selected FOG-M as a demonstration and testbed for Embedded Training (ET).

The following products are included within this report:

1. A discussion of ET development for the FOG-M demonstration that illustrates the status of overall guidelines for the development of ET in weapon systems.

2. A set of courseware outlines designed to provide training for the demonstration FOG-M so that a trainee can operate a demonstration FOG-M under constraints of system preparation (Appendix A).

3. The objectives hierarchy for the demonstration FOG-M used as a foundation for the courseware outlines (Appendix B).

4. A supplemental courseware outline designed to provide a brief (1-hour) overview of FOG-M and how it operates (Appendix C).

5. An objectives hierarchy for a projected "full" FOG-M system that will serve as starting point for further courseware development (Appendix D).

The courseware outlines were developed according to a model described in FOG-M Task and Training Requirements Analysis for Embedded Training (ET) (Purifoy, G. R., Jr., Chenzoff, A. P., Harris, C. B., Adams, J. E., Johnson, V. E., Frezza, D., and Roth, J. T., 1985). Some revisions were made to this model as it was applied. The model calls for a training objectives hierarchy, which was developed from information in both this report and in Design Concepts for FOG-M System Embedded Training (ET) (Purifoy, G. R., Jr., Harris, C. B., and Ditzian, J. L., 1985). The Training Requirements Analysis also specified a subset of top-level training objectives that would be appropriate for the demonstration FOG-M system. These determined the courseware to be developed.

The courseware development process took into account the hardware and software capabilities that are projected to exist in the demonstration FOG-M. These capabilities include the following:

1. Mock-up of FOG-M gunner console

2. Computer-assisted instruction capability

3. Computer-generated imagery for dynamic simulation of the view through the missile seeker

4. Videodisk presentation of still imagery

5. Voice narration during information presentation

6. Videotape record/playback.

The objectives hierarchy for a projected "full" FOG-M system was developed by extending the demonstration-level objectives hierarchy for the remaining objectives. This product reflects changes in objective numbers, as well as additional objectives.

The supplemental courseware outline is derived from elements of the demonstration courseware outline. The resulting course will acquaint interested personnel with the operation of FOG-M.

The courseware outlines are to be used for development of courseware for the demonstration FOG-M. This courseware will serve to introduce both FOG-M and ET and can be taken by prospective demonstration FOG-M gunners or by other persons interested in understanding either of these concepts. The courseware outlines present specific items of courseware and suggest how these items might be implemented in media. The supplemental courseware outline is specifically designed to provide an overview of FOG-M.

The objectives hierarchy for the demonstration courseware is provided in support of courseware development. The objectives hierarchy for the "full" FOG-M system will form the basis for further courseware development, should FOG-M reach this stage.

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FOG-M SYSTEM EMBEDDED TRAINING (ET) DEMONSTRATION COURSEWARE OUTLINES

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LIST OF ABBREVIATIONS

AML	Army Missile Laboratory
ARI	Army Research Institute
BITE	Built-In Test equipment
CAI	Computer-Assisted Instruction
CMI	Computer-Managed Instruction
CRT	Cathode Ray Tube (video screen)
DMA	Defense Mapping Agency
DMG	Digital Map Generator
EPROM	Erasable Programmable Read-Only Memory
ET	Embedded Training
ETR	Embedded Training Requirement
FOG-M	Fiber Optic Guided Missile
FOL	Fiber Optic Link
GS	Gunner's Station
HMMWV	High Mobility Multipurpose Wheeled Vehicle
ISD	Instructional System Development
JPA	Job Performance Aid
MICOM	Missile Command
NDU	Navigation Display Unit
PDP	Programmable Display Pushbutton
PM-TRADE	Project Manager for Training Devices
POI	Plan of Instruction
SOP	Standard Operating Procedures
UTM	Universal Transverse Mercator
VDP	Videodisc Player
VNAS	Vehicle Navigation Aids System
VRU	Vehicle Reference Unit

FOG-M SYSTEM EMBEDDED TRAINING (ET) DEMONSTRATION COURSEWARE OUTLINES

SECTION 1

INTRODUCTION

This report discusses an approach to the development of Embedded Training (ET) applied to the Fiber-Optic Guided Missile (FOG-M). This effort is part of a program within the Systems Research Laboratory, Information Systems Technical Area, of the Army Research Institute (ARI), to develop and implement ET within the Army system procurement process. The overall research program is co-sponsored by the Project Manager for Training Devices (PM-TRADE). - 3- to 1973 -

The overall program will produce ET development and implementation guidelines. One testbed is the FOG-M system. FOG-M is a technology demonstration under development by the Army Missile Command (MICOM) at Redstone Arsenal, Alabama. ARI is overseeing the development of an ET exemplar system for the FOG-M testbed. This exemplar system will help refine ET concepts and procedures for future possible implementation in other Army programs.

The present effort included four tasks: (1) develop an objectives hierarchy for a demonstration FOG-M ET course; (2) develop a courseware outline for this demonstration FOG-M ET course; (3) develop performance measurement guidelines to assist the software and hardware developers in the preparation of a specification for the FOG-M ET course; (4) develop an objectives hierarchy for a hypothesized fielded version of the FOG-M system to be used in subsequent courseware development for this system. These four tasks resulted in four products: (1) an objectives hierarchy for the demonstration FOG-M ET course; (2) a courseware outline integrating the objectives, courseware description, and performance measures; (3) a courseware outline for a special brief course to be given to personnel with limited time to acquaint themselves with the FOG-M (A VIP ET demonstration); and (4) an objectives hierarchy for a hypothesized fielded FOG-M system, to be used for future courseware development.

Background

The work documented in this report is based on the results of two prior efforts in the FOG-M system ET program. These are documented as follows: (Purifoy, G. R., Jr., Chenzoff, A. P., Harris, C. B., Adams, J. E., Johnson, V., Frezza, D., and Roth, J. T., FOG-M Task and Training

Requirements Analysis for Embedded Training (ET), 1985) and (Purifoy, G. R., Jr., Harris, C. B., and Ditzian, J. L., Design Concepts for FOG-M System Embedded Training (ET), 1985).

FOG-M Task and Training Requirements Analysis for Embedded Training reported an operational description of the FOG-M weapon system to be used against armored vehicles in an over-the-horizon or beyond-the-hill mode. This report also contained a task analysis that identified training objectives for the complete weapon system. Design Concepts for FOG-M System Embedded Training (ET) applied a developing ET model and selected the ET requirements. An ET concept for hardware and software was contained in this report. Also in this report was a subset of mission segments, selected as appropriate further development for the FOG-M demonstration.

The current report contains an outline of courseware for the FOG-M demonstration. This outline also used the FOG-M B-5 Specification Outline -- Revised 5 February 1985, and a B-5 specification change document dated 14 February 1985 (MICOM) in order to establish launch and mission planning procedures. Conversations with Mr. J. L. Baumann of MICOM also clarified operational procedures.

Purpose

This report presents a courseware outline for demonstration FOG-M ET training. The courseware outline will guide development of the actual courseware to be used by the trainees. The courseware outline

1. Defines the lessons that are to be taught.
2. Defines topics within the lessons.
3. Estimates training times.
4. States the classification level of each topic.
5. Describes each item to be taught.
6. Defines the media that are to be used for presentation of each item.
7. Ensures that all training objectives are taught.
8. Describes, in outline and note form, the details of graphics to accompany text courseware.

9. Describes any particular training or presentation techniques that should be used for specific material.

10. Describes the performance measures.

11. Establishes functional and performance requirements for software simulation.

There were secondary points of focus to this report as well. In order to serve the development of the courseware outline, an objectives hierarchy was developed. The objectives hierarchy is integrated into the courseware outline. The hierarchy was cross-checked against the courseware outline to ensure that the courseware trains all objectives.

A third focus was to communicate, to the hardware and software developers, the hardware and software requirements to present the courseware being developed. A performance measurement outline describes the performance measurement functions that must be accomplished to make the training system work. This outline is also integrated into the courseware outline.

The demonstration FOG-M ET objectives hierarchy was expanded to the objectives hierarchy for a hypothesized fielded FOG-M system. This separate full objectives hierarchy is for all training for a fielded FOG-M system, not just for ET.

SECTION 2

ACTIVITIES PERFORMED TO DEVELOP THE 1987 DEMONSTRATION COURSEWARE

Introduction

Overview of Activities

Activities consisted of review of the embedded training requirements summary in Design Concepts for FOG-M System Embedded Training (ET), along with the specification of the courseware for the demonstration. Using these sections of this report as guidance, Appendix B of the same report, FOG-M Gunner ET requirements and contingency ET requirements were also reviewed. These two lists of specific requirements stated the phases, functions, tasks, skills, and knowledges for performing the FOG-M gunner tasks that are to be trained using ET. These lists were reduced to those requirements that are appropriate to ET for the 1987 demonstration of the FOG-M.

Constraints and Goals of the 1987 Demonstration

Guidelines determined whether any aspect of required tasks, skills, and knowledges should be considered for ET in the 1987 demonstration. The guidelines are:

1. ET will be the primary means of delivering courseware for the demonstration program.

2. The range of potential trainees during the demonstration is vast, ranging from experienced TOW system gunners at the E7 level, to untrained E3's, to interested colonels and generals to civilians.

3. ET should develop gunner proficiency, but the ET requirements should not degrade the capabilities of the demonstration FOG-M testbed, or in any way detract from its ability to show its full potential as a weapon system.

4. This ET system is more than a selected subset of training for the FOG-M demonstration, it is also a demonstration of the capabilities of ET as a prospective means of field training for other complex weapon systems.

5. Incoming trainees are assumed not to have adequate training in the area of motor skills required for the FOG-M, such as manual tracking.

6. Some incoming trainees are assumed not to have adequate training in the area of cognitive skills required for the FOG-M, such as target detection, recognition, and identification.

7. Target recognition skills provide a good demonstration of the use of ET in the field.

8. The training prepared here will form a basis of a curriculum if a FOG-M-based system is developed.

9. Time estimates cannot be verified, since no training hardware, software, or courseware exists.

10. Some thought was given to presenting a fully automated flight, but it is not possible to dispense with the motor skills component and still give the operator a feeling of control over the weapon system.

11. Demonstration FOG-M ET is constrained to a single missile firing at one time.

12. ET for the demonstration will be a subset of that which would be appropriate for a fielded FOG-M system. The difference will be that some training topics will be eliminated from the demonstration due to hardware or cost-effectiveness constraints.

13. The FOG-M ET demonstration to be held in 1987 will focus on the missile launch and manual control of its flight. Support tasks, such as maintenance, or vehicle centered tasks, will not be covered.

Trainee-Oriented Aspects of Demonstration FOG-M

Training for the demonstration FOG-M differs qualitatively from what would be appropriate for a fielded system. The trainees to be served are different from those who would undergo regular MOS training as FOG-M gunners, and their reasons for training are more varied. Potential trainees include the following:

1. Personnel who are assigned to training. These personnel will be testing out various aspects of the system. They may be assessing the adequacy of training, or they may be preparing to operate a demonstration FOG-M for test purposes, or they may intend to operate a FOG-M simulator against various types of targets. These personnel would probably be assigned to this role by their commands.

2. Personnel who desire to take the training because of their own interest in embedded training, or in FOG-M. These personnel may have a limited amount of time, and may be interested in specific aspects of training, such as seeing a complete flight, or closely investigating the terminal phase and lock-on procedures, or assessing the value of a small block of ET for a specific purpose.

3. Personnel who require an overview of FOG-M, possibly including a feel for how it flies and what the difficulties of various flight phases might be.

To satisfy these varied goals, several adaptations of training were instituted that might not appear in a standard course. These adaptations are:

1. Trainees who fail to achieve an acceptable standard of performance would normally receive remedial work and retesting before being allowed to go on. For the demonstration, trainees may elect to go on even though they have not achieved satisfactory performance, because time may be the limiting parameter.

2. Trainees may elect to begin in the middle of the course in order to focus on one aspect of training.

3. There is a supplemental course that touches briefly on many aspects of FOG-M and which includes a flight demonstration.

4. Performance measurement records are limited to the session, rather than being kept permanently.

5. Target detection, identification, and recognition are contained within the training, even though the available technology does not permit these to be combined with flight. Specific interest in this topic has been expressed.

Summary of the Training System Goals

There are two reasons to develop ET for the demonstration FOG-M. One is that there will be a simulation of the FOG-M missile flight, and various personnel will be interested in how the missile is flown, how hard or easy it is to fly, what operational difficulties are likely to occur, and so forth. It is necessary to teach these various personnel how to fly the missile so that they can use the simulation and evaluate the missile design concept. The other reason is that FOG-M affords an opportunity to demonstrate how well ET works.

ET will be the only training medium for the demonstration system. An interested person should be able to sit down at the gunner's station and train on the missile piloting task, without need for much intervention by a trainer or instructor, or for extensive textbook preparation.

A soldier who takes the ET demonstration course should be able to: fire a FOG-M that has been programmed with a mission on azimuth, coordinates, or a planned route; navigate it to a target area; pick out a target; and lock the missile onto that target. This is the core of the training to be provided in a full training program.

In order to keep the required training for the demonstration to a workable time requirement, and to focus on those tasks and activities that are unique to the FOG-M, some basic assumptions about the scenarios were made:

1. The vehicle that carries the FOG-M is correctly positioned and the VNAS navigation system is aligned. This location can be given to the gunner trainee or programmed into the system.

2. The missile guidance system, when used in a planned mission mode, will have all the waypoints predetermined. These can be given to the gunner trainee and or programmed into the system.

3. Only contingencies for which there is already tentative doctrine will be included.

4. Unique parts of the missile's operation are the gunner's ability to monitor the missile in automatic flight, complete with video, and the missile's ability to respond to human control inputs in real time.

Steps in the Development of the Demonstration ET Courseware Outline

The courseware outline for the 1987 demonstration was developed within the framework of a series of activities. These activities stretched over extended periods of time, and each activity encompassed parts of several steps. These are the formal steps that had to be taken in order to develop the courseware outline in accordance with contractual and ISD requirements.

The steps in the development were:

1. Define Objectives--already partly accomplished prior to this effort.

2. Define Modules to Be Taught--already partly accomplished prior to this effort.

3. Assign Objectives to Modules.

4. Assign the Point at Which an Objective Was to Be Trained to Final Criterion.

5. Define Submodules Within Modules.

6. Specify Courseware to Achieve Submodule Goals.

7. Reassign Training and Objectives as Appropriate to Create Efficient Modules and Submodules.

8. Ensure That All Objectives Are Trained to Criterion.

9. Develop Testing and Measurement Requirements So That All Objectives Are Evaluated.

10. Develop a Short "VIP" Demonstration.

The activities undertaken to complete these steps are discussed below. The discussion of each activity will specify the steps addressed during that activity. Further work on the particular step may have occurred in subsequent activities.

Future efforts will include courseware development and formative and summative evaluation of that courseware. Summative evaluation will not take place until the hardware to run the training has been built.

Activity 1. Review the FOG-M Task Hierarchy to Identify Gross Training Requirements

The FOG-M Task Hierarchy, included as Appendix B in FOG-M Task and Training Requirements Analysis for Embedded Training (ET), was reviewed. The task list was refined so that it included only tasks relevant to the demonstration FOG-M.

This activity addressed step 1--Define objectives.

Activity 2. Review the Training Requirements Analysis to Define Skills and Knowledges

The Training Requirements Analysis, found in the Design Concepts for FOG-M Embedded Training report, was then reviewed. All relevant skills and knowledges were verified as included. The revised list of phases, functions, tasks, skills and knowledges for demonstration FOG-M ET is found in Appendix B of the current report.

This revision followed guidance established in the Design Concepts report, particularly the Embedded Training Requirements Summary in Section 2 and Courseware for the Demonstration, in Section 4, and in the FOG-M System Task and Training Requirements Analysis for Embedded Training (ET) report, Appendix C, Training Requirements. Also considered were the constraints and goals listed above. This eliminated the following phases from the task hierarchy (justifications for elimination are included):

Phase 0 Planning (ET possibilities were identified, but these tasks are expected to be performed by the FOG-M engineering staff for demonstration activities)

Phase 1 Prepa ıtion (no ET identified)

Phase 2 Move (ET only for communications tasks, which are not part of the demonstration)

Phase 3 Deployment (no ET identified)

Phase 4 Mission Planning (On-Site; ET only for communications tasks)

Phase 9 Expedient Egress (no ET, and probably not to be included in the demonstration)

Phase 10 Post-Deployment Operations (no ET, and probably not to be included in the demonstration)

The following phases remained:

Phase 5 Launch

Phase 6 Air Navigation (Missile)

Phase 7 Terminal Phase

Phase 8 Impact Assessment

New objectives were added where it was felt that there was not enough specificity to ensure adequate guidance for the courseware developers. In addition, all reference to multiple missile flight was eliminated.

This activity addressed steps 1--Define objectives, 2--Define modules to be taught, and 3--Assign objectives to modules.

Activity 3. Update the Objectives Hierarchy

The objectives hierarchy that was developed during the earlier portion of this program, based on the team's knowledge and the status of the FOG-M at the time, was updated based on new knowledge, after

identifying weak points. All changes were incorporated into a single objectives hierarchy database.

First, objectives were assigned to the modules defined in the Courseware subsection of the Design Concepts report. This assignment of objectives was accomplished by a determination of where each objective would be taught and where it would be "closed out." A closed out objective will not be taught or tested later in the course. Concurrently, the objectives were reviewed and revised such that each objective included a behavior that was to be taught within one lesson. Some of these objectives might not be closed out until a later lesson because proficiency requires further practice or integration.

The first draft of the objectives was derived entirely from the FOG-M task hierarchy. The hierarchy statements from the selected phases, noted above, were then altered so that they were in the form of behavioral statements. Conditions and standards were then added to these behavioral statements. Skills and knowledges that are prerequisites or are gained during the completion of each objective were also added.

The next draft of the objectives involved the addition of terminal and enabling objectives to present complete, coherent training to the operator. These objectives were shaped by assessing the goals of potential trainees. Information about a potential fielded FOG-M system, information about ET, and information about the capabilities of the demonstration FOG-M was added at this point.

This draft also reflected revisions designed to make the objectives easier to train. Objectives were numbered according to the tentative lesson assignment, and subdivided into enabling objectives until each lowest level objective contained a simple behavior. This simplified generation of behavioral performance measures. In order to maintain coherence and reduce errors, this numbering system was maintained without change through the rest of the program. New objectives were added within this framework.

This activity addressed steps 1--Define objectives, and 3--Assign objectives to modules.

Activity 4. Define the Instructional Management Plan and Delivery System

The first step in this activity was to define the format of the training analysis results. Any information presentation format was derived by reviewing an Army Plan of Instruction (POI) for the Infantry Advanced Officer Course, 2-7-C22, and adding elements from the Courseware Outline Format defined in our technical proposal for this contract. A review by ARI yielded further suggestions.

The decision was made to deliver both a POI and additional courseware detail. Additional courseware detail was needed early on so that the software and hardware developers of FOG-M ET could ensure that the supporting software and hardware are available in the demonstration system.

This activity was instrumental in the completion of steps 2--Define modules to be taught, 5--Define submodules, and 9--Develop testing and measurement requirements.

Activity 5. Place the 1987 Demonstration FOG-M ET System in a Real-World Context

Since ET was to be an information presentation tool as well as a training tool, revisions and additions were necessary. To serve the information presentation function, objectives were developed that were appropriate for a person taking ET for familiarization with FOG-M or for familiarization with ET, rather than for training to operate the weapon system itself. The new objectives resulted in lessons covering: (1) Introduction to FOG-M; (2) Introduction to ET; and (3) Introduction to the Demonstration FOG-M. The FOG-M introductory objectives are relevant to a fielded FOG-M system training program as well. Following an ARI review, it was decided to remove some of these sections and to collect them in a supplemental course for personnel who would have only a brief chance to interact with the demonstration FOG-M ET. This change was completed in activity 8, discussed below.

This activity addressed steps 1--Define objectives, 2--Define modules to be taught, 3--Assign objectives to modules, and 4--Assign the final training point.

Activity 6. Develop the Courseware

Training activities were developed, final points of training were specified, and submodules were developed. Each lesson was defined around a particular complex of skills required to operate the FOG-M. Because of this, some lessons have many parts, and others have few, and the time to complete the lessons is not uniform. It was decided that this approach would aid the trainee to focus on the goal of each lesson.

Lessons are defined to structure the sequence of learning. These were then subdivided into topics (submodules) that are smaller and more clearly defined than lessons. Topics were developed with an eye to defining clearly measurable performance. In other words, the lessons are defined solely for the benefit of the trainees, while the topics are defined for the purposes of the training developers and training staff as well as for the trainees.

After the courseware was outlined, a check was performed to make certain that courseware had been provided for every objective. A

notation was included where every listed objective was closed out. At this point, the trainee should have the target level of skill or knowledge for that objective.

This activity addressed steps 4--Assign final training, 5--Define submodules, 6--Specify courseware, 7--Reassign training and courseware for efficiency, and 8--Ensure that all objectives are trained.

Activity 7. Specify Performance Measurement

This activity took place concurrently with activity 5. The demonstration FOG-M ET hardware and software were not yet fully defined prior to the courseware outline development. Accordingly, the courseware development team stated functional requirements for performance measurement prior to the selection of hardware and development of software specifications.

Performance measures were defined on the basis of what can be expected to be measurable, given the postulated hardware and software of the demonstration FOG-M ET. The courseware developers attempted to specify these measures as early as possible, and reported these measures to the hardware and software development team, so that the latter could specify the hardware and software required to implement these measures. Along with this went cost and feasibility estimates for the proposed measures.

Two types of courseware resulted. One type involves the presentation of information, facts, and procedures, and the other involves the use of the FOG-M functions that might employ the FOG-M controls and displays or access the videodisk. Only these latter items were expanded in the performance measurement outline, because the information items are easily made self testing, or testable using a keyboard response and a multiple-choice format.

This activity addressed step 9--Develop measurement requirements.

Activity 8. Develop a Supplemental Course for Briefing Purposes

After the initial developmental process for the demonstration course was complete, and numerous possible applications of the courseware had been discussed with ARI and MICOM, it became apparent that two very different types of persons would come into contact with the training material. The first type of person would resemble a future FOG-M gunner. This person might evaluate the missile, the training, or ET itself, for various government purposes. He or she would have a moderate block of time, perhaps one full day, to devote to interaction with the training system.

The second type of person might be classified as an observer of FOG-M. He or she might be interested in getting a very brief overview of FOG-M or ET, and would want some hands-on experience, but would not evaluate FOG-M training, or ET.

With this in mind, parts of the course that dealt with explaining why the demonstration was constructed, and explaining the role of ET, were removed from the main course. An overview of FOG-M remained as an introduction, as well as a brief introduction to ET.

A second supplemental course was developed. It incorporated some of this surface-level material, and also incorporated some hands-on flight of the missile under simulated and very controlled conditions, so that the operator would see the missile's capabilities, and be able to exert some control over its subsystems (e.g., seeker) without fear of simply getting lost and not seeing a full mission.

SECTION 3

COURSEWARE DEVELOPMENT PRODUCTS

There are four products delivered as Appendices A through D of this report. Appendix A is the courseware outline for the demonstration FOG-M ET course, and it contains the results of several efforts, described earlier in this report. Appendix B is the objectives hierarchy used to develop this courseware outline for the demonstration FOG-M, and normally found in a POI. Appendix C is the outline for the supplemental course to be used as a brief introduction to the FOG-M. Appendix D is the objectives hierarchy for all training to be developed for a future fielded FOG-M system. The rest of this section describes the format and content of these four products.

Courseware Outline for the Demonstration FOG-M ET Course

The courseware outline is Appendix A. It presents three kinds of information: (1) objectives; (2) courseware outline material; and (3) performance measurement information. The first page of this outline is a Course Lesson Sequence Summary that includes training times by lesson and topic.

Objectives

Each lesson begins with a list of objectives. There is an objective for each training topic, but not for tests. The objectives contain:

1. Lesson number and title.
2. Topic name (and a letter if appropriate).
3. Estimates of the training time required for completion of the lesson (these estimates are not verified since the training has not been developed and tested).
4. Security classification of the lesson material (all information in this report and its appendices is unclassified).
5. Objective numbers.
6. Objectives.

7. Whether the training for each objective is complete at this point, or whether further training will occur. When an objective is complete the trainee should perform at the desired criterion level. An X in the "Complete" column means that the objective is complete at this point.

The objectives were developed and then refined, expanded, and deleted as necessary. The numbers corresponding to each objective are nominal. This is the last use of the demonstration FOG-M objectives hierarchy, and so it was not useful to renumber the objectives. This is why there are some gaps in the numbers of the objectives, and why no attempt was made to make the objective numbers correspond to lessons. However, the objectives are numbered so that the hierarchy is maintained. For example, objective 01.06.02 is an enabling objective to objective 01.06, which is in turn an enabling objective to objective 01.

Courseware Outline

There is a courseware outline for each topic, including the tests, containing:

1. Lesson number and title
2. Topic name (and a letter if appropriate)
3. Estimate of the training time required for completion of the lesson
4. Security classification of the lesson material (all information in this report and in the courseware is unclassified)
5. A series of number items to be presented.
6. Notes expanding on the graphics, flow, and performance measurement of each item

The teaching material is broken into items that each cover a single idea. Each item is to be presented using a consistent presentation approach throughout the item. For example, if the item consists of a series of presentations of pictures of targets, there would be some introduction to the item, and then each picture would be presented, accompanied by text and or questions.

The notes discuss the pictorial material, to help specify more exactly what kinds of graphic or video is expected. They also discuss possible items and flow sequences for adaptive training. In some cases, they expand on the depth or organization of the material to be presented, or recommend audio narration if it turns out to be available. Finally, they direct the courseware developer to further expansion of performance measurement approaches, to be found on the pages following.

There are five topics that are devoted to testing. In addition, some brief tests are integrated within other topics. The five tests were placed where it was felt that material would be integrated. These tests are:

1. Launch procedures
2. Navigation performance
3. Target detection performance
4. Target selection performance
5. Hitting the target

In addition, the last lesson is a full mission simulation.

Performance Measurement

Performance measurement specifications were developed in response to a need manifest within the ET development team. It was important to communicate among the courseware, software and hardware developers on this rather important area. The performance measurement material started out as an outline of functional requirements for the hardware and software. Once developed, it was clear they could be of benefit to future courseware developers as well, so it was decided to include them within the outline.

The performance measurements expand on specific items that involve perceptual-motor performance, and are integrated into the courseware outline directly after the particular item is initially discussed. The performance measurement data are:

1. Lesson number and title

2. Topic name (and a letter if appropriate)

3. Item from the particular lesson under discussion

4. Narrative that discusses the material to be presented, and the actions the gunner will take, to set the scene for the performance measurement details

5. Equipment required, actually the types of functions that the equipment must perform, such as the controls that must operate and the type of visual presentation required

6. Action that the gunner will demonstrate in correct performance

7. Performance measurement narrative explaining the type of measure required

8. Listing of the performance measures for easy reference

Feedback of Performance and Adaptive Training

Persons who sit down at the gunner's console to take training will come from varied backgrounds and will have varying reasons for taking FOG-M training. Some trainees will be representative of those who would be trained as FOG-M gunners were it to become a fielded weapon system. These persons will test the effectiveness of ET and the trainability of FOG-M operation. A second type of trainee will be trying to understand and evaluate how ET can be used in this and other systems to train many tasks. A third type of trainee will want to know how FOG-M works, as part of an overall evaluation of the weapon system concept.

The second and third types of trainees may not find it necessary to reach proficiency at many of the gunner's tasks, but may still want to be exposed to and participate in all the training activities provided in the ET course. Because of these varying reasons for training, it was decided that constraints on trainee progress through the course that would be appropriate for regular trainees, are not appropriate for demonstration FOG-M ET.

In particular, if a trainee fails to reach criterion on an item, the usual training procedure would be to initiate some remedial sequence. This might be simple (repeat the item) or complex (take a separate branch of training to cover the problem far more thoroughly). Remediation of this sort is provided, but the trainee may reject this remediation and continue as if no problem existed. A menu of choices allows the trainee to select the next action. This approach affords flexibility to accommodate the different types of persons who will use the demonstration FOG-M training.

Objectives Hierarchy for the Demonstration FOG-M ET System

This objectives hierarchy will be found in Appendix B. The development of this hierarchy from the task listings and the constraints for the demonstration was the first step in developing the courseware outline for demonstration FOG-M ET. The term ET is specified here because some of the constraints had to do specifically with the intended content and scope of ET to be included in the demonstration FOG-M.

The objectives hierarchy is constructed around 12 terminal objectives:

01. Understand the FOG-M

02. Understand embedded training (ET)

03. Understand the capabilities of the demonstration FOG-M

04. Understand and recognize FOG-M equipment understand fundamental FOG-M parameters

05. Perform launch procedures

06. Use the seeker

07. Control missile flight

08. Navigate missile

09. Detect/select targets

10. Guide missile during terminal phase

11. Assess impact

12. Perform a full FOG-M mission

Each objectives page contains the following information:

1. Number of the objective

2. Number of the lesson in which this objective will be closed out

3. Title of the objective

4. Conditions of performance

5. Standards of performance

6. Skills required or that must be mastered by objective completion

7. Knowledges that must be gained by objective completion

These objectives were conceptualized in the form stated above. They were then assigned to training lessons in a sequence that optimized the training. One of the pieces of data is the lesson assignment for each objective. Terminal objectives 02 and 03 and their associated enabling objectives do not have lessons associated with them. After the development of the objectives hierarchy, the government suggested that these objectives might not be appropriate for most of the persons who would come into contact with the demonstration FOG-M ET system. The training developers agreed with this suggestion, and deleted this material from the demonstration FOG-M ET courseware outline. Some of it appears in the supplemental course that will be found in Appendix C.

Courseware Outline for the Demonstration FOG-M Supplemental Course

The supplemental courseware outline is Appendix C. It contains only pages for objectives and for the courseware outline. The format for these pages is the same as that for the courseware outline found in Appendix A. The course consists of a single lesson, entitled Introduction and Demonstration, broken into three topics: (1) What is FOG-M? (2) What is Embedded Training (ET)? and (3) FOG-M Flight Demonstration.

This course is expected to take about 55 minutes, 25 minutes for the first two topics, and about 30 minutes to go through the material for the flight demonstration, which includes: a demonstration of the use of the seeker; a demonstration of how target detection and selection would be trained; a demonstration of the lock-on procedure; and an opportunity to run a mission that is already planned. During this mission the system can do everything--that is, it can launch, cruise to the target area, and lock on. The operator is taken through some of the steps, but the system takes over if he makes a mistake. The last topic consists of the instruction for these functions as well as the mission itself. The mission is part of the instruction, it does not follow the instruction.

Objectives Hierarchy for the Fielded FOG-M System

The objectives hierarchy for the fielded FOG-M is Appendix D. This hierarchy is directed at all potential training to be conducted for the full FOG-M, whether ET or other training. It covers all phases of FOG-M flight, system preparation, missile flight parameter determination and input, and the possible contingencies that may occur while using the FOG-M.

The hierarchy is constructed around 14 terminal objectives (with a numbering scheme that is not the same as that for the demonstration FOG-M ET objectives):

01. Know the basis of operation of FOG-M

02. Prepare FOG-M for a mission

03. Move FOG-M

04. Deploy FOG-M at a launch site

05. Plan a missile flight

06. Perform missile launch

07. Use the seeker

08. Control missile flight

09. Navigate a missile salvo

10. Detect/select targets

11. Achieve lock-on or guide missile during terminal phase

12. Assess missile impact

13. Depart the launch site

14. Perform a full FOG-M mission

Each objectives page contains the following information:

1. Number of the objective

2. Whether the objective is suitable for ET

3. Skill level at which the objective should be taught (I = Introductory; S = Sustainment; E = Expert).

4. Title of the objective

5. Conditions of performance

6. Standards of performance

7. Skills required or that must be mastered by objective completion

8. Knowledges that must be gained by objective completion

The fielded system objective hierarchy is renumbered and does not relate directly to the demonstration objective hierarchy. Many of the demonstration objectives are contained within the full hierarchy, but those that pertain only to the demonstration are not included in the full hierarchy. A large number of objectives are included in the fielded system hierarchy that relate directly to part of the system that is not to be taught by the demonstration ET system.

The determination of the appropriateness of ET was made using the Training Objective/Task-Level ET Decision Model developed in the FOG-M Task and Training Requirements Analysis for Embedded Training (ET) report delivered earlier in this contract. A Y (Yes) or a N (No) in the column indicating ET suitability shows whether the objective appears to be good one for ET. It is important to note that this rating does not indicate whether ET appears to be one of the best ways to teach the item.

The skill level column contains a rating of whether this objective should be taught in the context of various levels of training at FOG-M gunnery. The ratings were made for all objectives. The three training levels were Introductory, Sustainment, and Expert. Here are the working definitions that were used in the determination of whether any objective fit into one or more categories:

I Introductory training. This is training given to a new trainee, at any level where new skills or knowledges must be acquired.

S Sustainment training. Sustainment training trains to operational standard and verifies that the operator meets the operational standard for the objective. Sustainment trainable objectives are of moderate to high perishability and/or are highly mission critical.

E Expert training. Expert training extends the capabilities of the person-machine system. It does this by: (1) training existing objectives to higher than operational standard; or (2) establishing and training new objectives that extend the capability of the man-machine system.

These definitions are not sacrosanct, and remain to be refined by further thought, application, and research. Expert training reflects a new way of looking at the possibilities of ET. The ordinary Army weapon system operator achieves operational standard as a matter of course, but often is frustrated in becoming a real master at his weapon system. It is this area of training, beyond what is originally envisioned in the basic weapon requirements documents, that is of interest. This is where the soldier can make his contribution to force multiplication. Further research into this important area should be pursued.

Conditions include the conditions under which the objective behavior must be demonstrated, and standards specify how good the performance must be. In many objectives an additional standard is specified if the item is selected as an expert item.

Skills and knowledges are those that either must be brought to the training situation or must be brought away from it when the objective is certified as fully learned.

SECTION 4

COURSEWARE

The courseware outlines presented in Appendices A (regular demonstration course) and C (supplementary course) are descriptions of the ways in which knowledges and skills are to be presented. The training described in these outlines will be presented within a courseware presentation framework that reflects good training practice combined with the hardware and software that is projected to be available for the FOG-M demonstration. This section discusses the framework used to present training.

Training Strategy

The demonstration FOG-M courseware is designed to train someone unfamiliar with FOG-M in the operation of the demonstration system. A person without the need to become proficient in the guidance of a missile to a target can still interact with all lessons and components within those lessons. On the other hand, a person who requires proficiency should be able to use the same lessons to gain the knowledge necessary for basic missile operation, and for further skill development to improve guidance skills. This increased level of proficiency probably requires repetition of the later, more psychomotor skill-oriented lessons to improve performance to an acceptable level.

A course lesson sequence summary that lists lessons, topics, and estimated training times, is found in Table 4-1. Training times are projected for the "one-time through" trainee who is seeking familiarity rather than proficiency.

The first lesson is entitled "What is FOG-M?" It introduces the FOG-M and FOG-M ET demonstration, along with the rest of the training. The first topic, "Introduction and Training Overview," has several purposes:

1. It introduces the trainee to the existence of the FOG-M missile concept.

2. It tells the trainee that this training is part of a demonstration of FOG-M potential capabilities.

3. It orients the trainee with regard to what skills are expected prior to training (map reading).

Table 4-1. Course Lesson Sequence Summary

Lesson/ Topic	Title	Training Type	Time
1	What is FOG-M?	CAI, PE4	75 min.
1A	Introduction and Training Overview	CAI	15 min.
1B	What is FOG-M?	CAI, PE4	60 min.
2	FOG-M System Equipment Summary (C)	CAI	30 min.
3	Launch	CAI, PE4	120 min.
3A	Familiarization and Background	CAI	30 min.
3B	Launch Procedures	CAI	60 min.
3C	Launch Procedures Test	PE4, E1	30 min.
4	Using the Seeker	CAI, PE4, E1	30 min.
5	Navigating the FOG-M	CAI, PE4, E1	105 min.
5A	Relating Map Display to Seeker Video	CAI, PE4	30 min.
5B	Controlling Flight During Cruise	PE4, E1	30 min.
5C	Navigation Performance Test	PE4, E1	15 min.
5D	Adjustment During Cruise	CAI, PE4, E1	30 min.
6	Target Detection, Recognition, and Identification	CAI, PE4, E1	120 min.
6A	Detect Target	CAI, PE4, E1	30 min.
6B	Detect Target Under Camouflage/Obscuration	CAI	30 min.
6C	Target Detection Performance Test	CAI, PE4, E2	30 min.
6D	Recognize/Identify Targets	CAI, PE4	15 min.
6E	Target Recognition/Identification Performance Test	PE4	15 min.
7	Hitting the Target	CAI, PE4, E1	45 min.
7A	Hitting the Target	CAI, PE4, E1	30 min.
7B	Performance Test	PE4, E1	15 min.
8	Missile Impact Assessment	CAI	15 min.
9	Full Mission Simulation	CAI, PE4, E1	30 min.

CAI - Computer-Assisted Instruction
PE4 - Simulation
E1 - Hardware Performance Evaluation
E2 - Nonhardware Performance Evaluation

Total course time = 570 min./9.5 hrs.

4. It describes how to operate the training system.

5. It describes the training content.

The second topic, "What Is FOG-M?" expands on FOG-M purpose, hardware, and capabilities, and ends with a demonstration flight that is not under trainee control.

Lesson 2, "FOG-M Equipment Summary," is a formal presentation of hardware and nomenclature. Capabilities of FOG-M are explained in this lesson. The classification of this lesson has been projected to be Confidential, but classification can be adjusted by selection of capabilities to be presented.

The remaining lessons present skills and knowledges in approximate order of their use in a FOG-M mission. This organization was adopted because the trainees will have little or no pretraining on FOG-M, and may have no instructors or subject-matter experts. A mission-oriented sequence of lessons is easy to understand.

Lesson 3, "Launch," presents the operations needed to launch a missile. The first topic, "Familiarization and Background," describes the programmable display pushbuttons (PDPs) and the types of missions (preset route, fire on coordinates, fire on azimuth). The second topic, "Launch Procedures," covers the procedures and PDP sequences to launch a FOG-M missile. The third topic, "Launch Procedures Test," evaluates the trainee's ability to launch a missile successfully.

Lesson 4, "Using the Seeker," instructs use of the FOG-M seeker to look at terrain and targets. Some practice is included in spotting and marking possible targets. This lesson does not include flight control, and therefore represents an easy way to familiarize a trainee with the view from the missile seeker.

Lesson 5, "Navigating the FOG-M," covers some of the most difficult FOG-M gunnery material. The first topic, "Relating Map Display to Seeker Video," is an important step in the control of missile flight. The trainee sees cultural and terrain features that he must relate to the map display. The first topic, "Controlling Flight During Cruise," relates the visual scene to what is happening to the missile, and involves integration of scene information with other information available to the gunner, such as altitude and azimuth. The gunner adjusts flight parameters during flight.

A test was established at this point ("Navigation Performance Test") to assess whether the trainee has sufficient skill at navigating and maintaining the missile on a steady course, prior to proceeding to the fourth topic in Lesson 5, "Adjustment During Cruise," during which the gunner makes flight path control inputs after diagnosing failure of automatic control during flight. Failure of automatic control requires that the gunner reorient the missile manually and find a target area based on visual cues and other available information.

Lesson 6, "Target Detection, Recognition, and Identification," is the next activity that an actual FOG-M gunner would undertake during flight. The process of finding targets has been subdivided into two parts: (1) detecting possible targets and discriminating them from other ground features; and (2) recognizing and identifying targets with respect to friend/foe and priority. Topic 6A, "Detect Target," presents likely targets in situations that would occur on a battlefield. Cues to target detection are taught (e.g., track trails). Topic 6B, "Detect Target Under Camouflage/Obscuration," puts the targets into likely battlefield conditions, including the use of camouflage netting, smoke, and fog. This training requires high quality still imagery. Topic 6C, "Target Detection Performance Test," assesses understanding of detection techniques before proceeding to recognition and identification of targets.

Topic 6D is "Recognize and Identify Targets" in which high fidelity imagery is used to familiarize trainees with targets and their priorities. These targets are to be selected from among other possible targets. The targets and distractors are representative of those a gunner would see on the battlefield. The target views are front, side, and rear views, but if imagery from above front, above side, and above rear is available, then this would be more suitable. Topic 6E is "Target Recognition/Identification Performance Test." Lesson 6 is designed to illustrate how target recognition training and practice can be fitted into an ET presentation format.

Lesson 7, "Hitting the Target," returns to direct involvement with missile flight control. It teaches operation of the missile in the terminal phase, including acquiring a lock on a target, breaking lock if necessary, and guiding the missile in manual mode. This lesson also illustrates the technique of training psychomotor skills using a specially designed exercise rather than a simulated seeker view. This allows the trainee to concentrate on the tracking task, without distraction. The second topic in Lesson 7 is a "Performance Test."

Lesson 8 covers "Missile Impact Assessment," in both real time and replay. This lesson teaches the operation of the video recorder. The recorder was not trained until this point because it does not aid in missile control or target acquisition.

Lesson 9, "Full Mission Simulation," integrates all parts of the training and culminates with a flight to a target area and a target strike.

The supplemental lesson, "Introduction and Demonstration," found in Appendix C, is designed for those who desire an overview of FOG-M and ET. The first topic, "What is FOG-M?" presents facts about the FOG-M concept. The second topic, "What is Embedded Training?" introduces ET. These are short topics (15 and 10 minutes respectively). The "FOG-M Flight Demonstration," Topic C (30 minutes), requires little input from the trainee, and will find a target if left to itself.

Types of Instruction

In order to assess the types of instruction appropriate for FOG-M, the courseware outlines were reviewed on an item-by-item basis. All instruction is presented via the FOG-M gunner's console, but this instruction falls into several categories. This information will be used to produce courseware to fulfill the specifications of the courseware outlines. This subsection defines the types of training used for FOG-M. Table 4-2 presents types of training utilized in the courseware outlines.

Definitions. TRADOC Reg. 351-1 (Training Requirements Analysis System), a guide for the preparation of a POI, was used to determine the types of training. The following definitions are reproduced from that document.

> Computer-Assisted Instruction (CAI). A man-machine interaction accomplished by use of the computer in direct support of a training situation.
>
> Practical Exercise. A practical application, performed under controlled conditions by the student, of the actions specified in the lesson objectives. Only one category of practical exercise was used in FOG-M training:
>
> > PE4. Simulation capability of the FOG-M trainer. This is a subcategory invented for the FOG-M program, since all training takes place at a trainer, and no actual equipment is specified.
>
> Examination. The formal evaluation of a student's achievement of specified learning objectives. The two categories of formal evaluation used in FOG-M are:
>
> > E1. Hardware performance evaluation.
> >
> > E2. Nonhardware performance evaluation.

Decision Rules. The following rules were applied to determine the type of instruction called for by each item, within each topic, within each lesson.

(1) If the item provides the trainee with only information or instructions, then the item utilizes CAI.

(2) If the item employs a scenario in which automated or mechanical inputs are required from the trainee, then the item is classified as PE4.

(3) An examination that requires only statements of fact or selection of a knowledge choice is classified as E2.

(4) An examination involving performance of skilled activity using the simulation capability is classified as E1.

Table 4-2. Type of Instruction

Lesson	Topic	Item	Type of Instruction/ Estimated Time
1	A	1	(CAI, 0:01)
		2	(CAI, 0:03)
		3	(CAI, 0:04)
		4	(CAI, 0:07)
		Topic A	(CAI, 0:15)
	B	1	(CAI, 0:01)
		2	(CAI, 0:03)
		3	(CAI, 0:03)
		4	(CAI, 0:05)
		5	(CAI, 0:15)
		6	(CAI, 0:15)
		7	(CAI, 0:10)
		8	(PE4, 0:03)
		9	(CAI, 0:05)
		Topic B	(CAI, 1:00)
		Lesson 1	(CAI, 1:15)
2		1	(CAI, 0:01)
		2	(CAI, 0:09)
		3	(CAI, 0:05)
		4	(CAI, 0:15)
		Lesson 2	(CAI, 0:30)
3	A	1	(CAI, 0:02)
		2	(CAI, 0:03)
		3	(CAI, 0:05)
		4	(CAI, 0:10)
		5	(CAI, 0:10)
		Topic A	(CAI, 0:30)
	B	1	(CAI, 0:02)
		2	(CAI, 0:05)
		3	(CAI, 0:08)
		4	(CAI, 0:05)
		5	(CAI, 0:02)
		6	(CAI, 0:08)
		7	(CAI, 0:10)
		8	(CAI, 0:05)
		9	(CAI, 0:05)
		10	(CAI, 0:05)

CAI - Computer-Assisted Instruction
PE4 - Simulation
E1 - Hardware Performance Evaluation
E2 - Nonhardware Performance Evaluation

Table 4-2. Type of Instruction (Continued)

Lesson	Topic	Item	Type of Instruction/ Estimated Time
		11	(CAI, 0:05)
		Topic B	(CAI, 1:00)
	C	1	(E1, 0:15)
		2	(E1, 0:15)
		Topic C	(E1, 0:30)
		Lesson 3	(CAI, E1, 2:00)
		1	(CAI, 0:02)
		2	(CAI, 0:08)
		3	(CAI, 0:05)
		4	(CAI, PE4, 0:05)
		5	(CAI, 0:05)
		6	(E1, 0:05)
		Lesson 4	(CAI, E1, 0:30)
5	A	1	(CAI, 0:02)
		2	(CAI, 0:04)
		3	(CAI, PE4, 0:12)
		4	(PE4, 0:12)
		Topic A	(CAI, PE4, 0:30)
	B	1	(CAI, 0:02)
		2	(CAI, 0:05)
		3	(CAI, 0:03)
		4	(CAI, 0:03)
		5	(CAI, 0:03)
		6	(CAI, 0:03)
		7	(CAI, E1, 0:06)
		8	(CAI, E1, 0:05)
		Topic B	(CAI, E1, 0:30)
	C	1	(E1, 0:05)
		2	(E1, 0:05)
		3	(E1, 0:05)
		Topic C	(E1, 0:15)
	D	1	(CAI, 0:02)
		2	(CAI, 0:10)
		3	(CAI, 0:03)
		4	(CAI, 0:03)
		5	(E1, 0:12)
		Topic D	(CAI, E1, 0:30)
6	A	1	(CAI, 0:02)
		2	(CAI, 0:10)
		3	(CAI, 0:15)

CAI - Computer-Assisted Instruction
PE4 - Simulation
E1 - Hardware Performance Evaluation
E2 - Nonhardware Performance Evaluation

Table 4-2. Type of Instruction (Continued)

Lesson	Topic	Item	Type of Instruction/ Estimated Time
		4	(E1, 0:03)
		Topic A	(CAI, E1, 0:30)
	B	1	(CAI, 0:02)
		2	(CAI, 0:04)
		3	(CAI, 0:04)
		4	(CAI, 0:04)
		5	(CAI, 0:04)
		6	(CAI, 0:04)
		7	(CAI, 0:04)
		8	(CAI, 0:04)
		Topic B	(CAI, 0:30)
	C	1	(CAI, 0:02)
		2	(PE4, E2, 0:28)
		Topic C	(CAI, PE4, E2, 0:30)
	D	1	(CAI, 0:02)
		2	(CAI, 0:02)
		3	(CAI, 0:02)
		4	(CAI, 0:02)
		5	(PE4, 0:02)
		6	(PE4, 0:03)
		7	(PE4, 0:02)
		Topic D	(CAI, PE4, 0:15)
	E	1	(PE4, 0:15)
		Lesson 6	(CAI, PE4, E1, E2, 2:00)
7	A	1	(CAI, 0:02)
		2	(CAI, 0:05)
		3	(CAI, 0:03)
		4	(CAI, 0:05)
		5	(E1, 0:06)
		6	(E1, 0:09)
		Topic A	(CAI, E1, 0:30)
	B	1	(E1, 0:15)
		Lesson 7	(CAI, E1, 0:45)
8		1	(CAI, 0:02)
		2	(CAI, 0:03)
		3	(CAI, 0:03)
		4	(CAI, 0:04)
		5	(CAI, 0:03)
		Lesson 8	(CAI, 0:15)

CAI - Computer-Assisted Instruction
PE4 - Simulation
E1 - Hardware Performance Evaluation
E2 - Nonhardware Performance Evaluation

Table 4-2. Type of Instruction (Continued)

Lesson	Topic	Item	Type of Instruction/ Estimated Time
9		1	(CAI, 0:02)
		2	(CAI, 0:28)
		Lesson 9	(CAI, 0:30)

CAI - Computer-Assisted Instruction
PE4 - Simulation
E1 - Hardware Performance Evaluation
E2 - Nonhardware Performance Evaluation

Training System

Hardware and Functional Capabilities

Successful training requires courseware and an appropriate means of presenting that courseware. The training system for the demonstration FOG-M is projected to consist of the following hardware and functional components:

1. mock-up of FOG-M gunner console
2. computer assisted instruction capability
3. computer generated imagery (CGI) for dynamic simulation of the view through the missile seeker
4. videodisk presentation of still imagery
5. voice narration during information presentation
6. videotape record/playback.

The trainee will sit at the gunner's console, which has a computer-driven display screen and a keyboard. Upon initiation of training, the computer system will request information from the trainee concerning where he or she would like to start. For the demonstration no provision has been made for storage of administrative data beyond the immediate needs of the training presentation. That is, the system will not remember who has started training or where a trainee is in the training process, beyond the immediate knowledge required for performance feedback on an item-by-item basis, or for adaptive training within a lesson at a single training session.

Remediation and Branching

At numerous points during the training the trainee receives feedback based on performance measurement. These points serve as decision points, where adaptive training or a computer algorithm can be applied to direct the student to remediation or continuation with the lesson. For the purposes of the demonstration the computer should determine the next step in training, but the trainee should have the option of circumventing the training strategy if need be because his or her goals may not include the need to develop full proficiency. A second factor influencing this decision is that contingencies of personnel and equipment availability may potentiate other schedules. Trainees may have to be moved on and off the training equipment without benefit of careful scheduling.

Accordingly, branching and remediation decisions are subject to trainee confirmation, and the trainee may select to proceed onward despite a failure to reach standard performance. Any particular trainee may be instructed to make a specific choice at these points, and the training system will then guide the progress.

In addition to this freedom of choice, at each item the trainee is to be given the choice of leaving the training lesson altogether, and either selecting another lesson or leaving the training environment.

Visual Representations

The hardware capabilities of the demonstration FOG-M include a videodisk player and CGI. It is projected that videodisk imagery will be available as still imagery of actual potential targets and friendly distractor targets, and as still imagery of terrains, but that not enough videodisk imagery can be made available to allow the use of videodisk for scene presentations for dynamic flight simulation. This state of affairs, combined with costs of providing free flight paths using the videodisk approach, has led to a determination by MICOM to utilize CGI for flight path and target imagery in a dynamic visual mode. The CGI will not be able to mimic actual target imagery with a level of fidelity necessary for target detection, identification, and recognition to be combined with flight control and final missile lock-on. Therefore target detection, identification, and recognition are taught using still videodisk imagery, while dynamic flight control and dynamic terrain recognition and direction following utilize CGI.

Adaptive Training

Adaptive training means that some adjustment of training is made based on individual trainee performance measurement and assessment, in order to assist that trainee in the learning process. Adaptive training allows variation in the pace of training such that quick learners proceed through training more quickly than slow learners, and the training designer does not have set one learning pace for all.

Certain points in the demonstration FOG-M course were identified as suitable for adaptive training. The following discussion presents those points and discusses how the training software can apply adaptive techniques to assist the trainee. The recommendations discussed below incorporate several ways of applying adaptive techniques. One way is to sense when the trainee has made too many mistakes, and to branch automatically to a review of material presented earlier that may not have been thoroughly learned. A second way is to adjust the difficulty of the problem. A third way is to offer special help when a trainee has problems, but none if the trainee succeeds without help. Examples are found below.

Lesson 4. In item 6b i the missile video represents a cruise over terrain with various items or features to be marked. The purpose of this item is to train how to operate the seeker slew, zoom, and iris controls. The speed of the first scenario is half regular cruise speed. If the gunner cannot mark nine out of ten features, speed is again halved. If criterion is achieved at quarter speed, the next scenario is doubled to half speed. After the gunner first achieves nine out of ten targets (regardless of the speed at which it is achieved), subsequent scenarios must be failed twice before the speed is reduced for the next presentation (this allows two tries at each speed before a downward adjustment). Criterion is nine objects out of ten marked correctly at full missile cruise speed. This item illustrates how an item may be made easier for adaptive training. This item is also an example of how adaptive training can be used to adjust training quickly at the outset. The first adjustment of speed is made after a single failure. Once the trainee has succeeded, the speed is not reduce unless failures occur twice in succession.

In item 7 the requirement is to maintain the cross hairs on targets as the cruise proceeds. For each of the four conditions training terminates when the gunner reaches criterion on three successive trials.

Lesson 5 Topic A. In items 4a and 4c, the gunner finds objects and terrain features via seeker video, and correlates these to the map representation in order to navigate successfully to the target area. The gunner views terrain through the seeker as the missile flies a preplanned route. Speed of flight over the terrain is under software control. Imagery is first presented as if the missile were flying slowly; speed is increased as the gunner successfully completes the feature identification task. If the gunner fails to reach a 90 percent criterion on two successive flights, speed is reduced for the next flight. To reach criterion the gunner must successfully reach the actual missile speed and identify targets at the 90 percent level.

Lesson 5 Topic B. In item 7 the missile is in flight and the task is to detect and correct deviations from specified flight parameters (pitch, roll, altitude, and azimuth). The trainee is first presented with deviations of one parameter. When performance has reached criterion on each of the four parameters, then more than one parameter deviates at the same time. Two parameters deviate until the trainee has successfully corrected both on one flight, then three parameters deviate. Criterion performance is defined as successfully correcting three deviations on a single flight. If corrective inputs are not made within five seconds from the beginning of the deviation, cues are presented to guide performance:

(1) if the correct adjustment is not initiated within five seconds after the deviation has begun, an audible warning indicates that some parameter has deviated;

(2) if the correct adjustment is not initiated within 10 seconds after the deviation has begun, a text message indicates the parameter(s) out of tolerance;

(3) if the correct adjustment is not initiated within 15 seconds after the deviation has begun, a text or graphic message indicates the control actions required to make the correction, and assistance is continued until the missile is back within acceptable flight parameters.

If the gunner has already begun the appropriate actions prior to cue 1, 2, or 3, then the next cue is not presented. Criterion performance requires correction of all flight parameter deviations before any cues are given. The trainee must reach criterion on one flight at each level (one, two, and three parameters) before proceeding. This item is an example of special help that is provided only if the trainee requires it.

Lesson 6 Topic D. This topic covers the recognition and identification of targets. Items 2 through 5 present the basic training and familiarization, and items 6 and 7 are practical applications of the knowledge of targets. In item 6 high priority targets must be picked out from scenes containing high and low priority targets. In item 7 enemy targets must be discriminated from friendly non-targets of a similar type. In items 6 and 7, a failure to identify a target correctly returns the trainee to material from the earlier items. A failure on item 6 returns the trainee to material from item 2 and a failure on item 7 returns the trainee to material from item 4. This item illustrates adaptive training that uses a return to earlier material for remediation.

APPENDIX A

COURSEWARE OUTLINE FOR THE DEMONSTRATION FOG-M ET COURSE

Appendix A is the structured outline for courseware relevant to the Demonstration FOG-M ET Course. The first page of each lesson contains the objectives; the second page contains the lesson outline itself. Also included in the lesson outline is a performance measurement and feedback of performance specification which expands on specific items involving perceptual-motor performance. These performance measurements and feedback of performance specifications are integrated dir ctly into the lesson at the point where a particular item is initially discussed.

Course Lesson Sequence Summary

Lesson/ Topic	Title	Training Type	Time
1	What is FOG-M?	CAI, PE4	75 min.
1A	Introduction and Training Overview	CAI	15 min.
1B	What is FOG-M?	CAI, PE4	60 min.
2	FOG-M System Equipment Summary (C)	CAI	30 min.
3	Launch	CAI, PE4	120 min.
3A	Familiarization and Background	CAI	30 min.
3B	Launch Procedures	CAI	60 min.
3C	Launch Procedures Test	PE4, E1	30 min.
4	Using the Seeker	CAI, PE4, E1	30 min.
5	Navigating the FOG-M	CAI, PE4, E1	105 min.
5A	Relating Map Display to Seeker Video	CAI, PE4	30 min.
5B	Controlling Flight During Cruise	PE4, E1	30 min.
5C	Navigation Performance Test	PE4, E1	15 min.
5D	Adjustment During Cruise	CAI, PE4, E1	30 min.
6	Target Detection, Recognition, and Identification	CAI, PE4, E1	120 min.
6A	Detect Target	CAI, PE4, E1	30 min.
6B	Detect Target Under Camouflage/Obscuration	CAI	30 min.
6C	Target Detection Performance Test	CAI, PE4, E2	30 min.
6D	Recognize and Identify	CAI, PE4	15 min.
6E	Target Recognition/Identification Performance Test	PE4	15 min.
7	Hitting the Target	CAI, PE4, E1	45 min.
7A	Hitting the Target	CAI, PE4, E1	30 min.
7B	Performance Test	PE4, E1	15 min.
8	Missile Impact Assessment	CAI	15 min.
9	Full Mission Simulation	CAI, PE4, E1	30 min.

CAI - Computer-Assisted Instruction
PE4 - Simulation
E1 - Hardware Performance Evaluation
E2 - Nonhardware Performance Evaluation

Total course time = 570 min./9.5 hrs.

OBJECTIVES

Lesson Number: 1 Lesson Title: What is FOG-M?

Topic: A. Introduction and Training Overview

Topic training time: 15 min. Clas:U

Enabling Objective		Complete
00.	STATE THE CONTENTS OF THE FOG-M ET TRAINING COURSE FOR THE DEMONSTRATION FOG-M	X

COURSEWARE OUTLINE

Lesson Number: 1 Lesson Title: What is FOG-M?

Topic: A. Introduction and Training Overview

Topic training time: 15 min. Clas:U

Content	Notes
1. Lesson introduction frame, estimated time, and narrative of topics to be covered. Lesson 1 describes FOG-M. Topic 1A describes the course.	
2. Narrative discussing: a. The existence of FOG-M in the concept development stage. b. The existence of this demonstration. c. The fact that this course is a demonstration of embedded training as a generic concept applicable independent of FOG-M. d. Map reading is a prerequisite for lessons 5-9. e. How to operate the demonstration FOG-M ET system.	Very little depth of coverage is required here. The purpose of this narrative is to orient the user to the demonstration FOG-M system operation.
3. Frame sequence illustrating how CAI will present information. Present the following topics: a. How to long on. b. How to respond to a question. c. How to step back. d. How to leave the sequence of training. e. How to move to a different item, topic, or lesson.	
4. Narrative discussing the remaining lessons. a. Lesson 1 is an introduction to FOG-M. b. Lesson 2 is a familiarization with the equipment and controls that are part of the gunner's station of the FOG-M system. c. Lesson 3 teaches launch procedures and will result in a simulated missile launch. d. Lesson 4 teaches how to use the seeker, which is a video camera in the nose of the missile. This is the first lesson to utilize the FOG-M video.	

COURSEWARE OUTLINE

Lesson Number: 1 Lesson Title: What is FOG-M?

Topic: A. Introduction and Training Overview

Topic training time: 15 min. Clas:U

Content	Notes

e. Lesson 5 teaches missile navigation, which requires both motor coordination and the understanding of concepts of navigation. In addition, the trainee will practice recognizing terrain features and relating them to their digitized map display representations.

f. Lesson 6 teaches target detection, recognition, and identification selection. This lesson integrates use of the seeker with the ability to recognize targets at a distance. This lesson will proceed all the way up to target detection and selection under adverse conditions of visual obscuration. It will also deal with the need to identify friend or foe.

g. Lesson 7 teaches missile guidance during the terminal phase of flight, when the missile homes onto a target and finishes the flight with target impact. The target lock-on feature will be demonstrated, and the gunner will learn how to make last-minute judgments about whether to remain locked onto the originally selected target, or to select an alternative target.

h. Lesson 8 teaches impact assessment, based on video from the FOG-M. Assessment can take place in real time, as the missile nears impact, and it can take place following impact, using the video recording function. Furthermore, a second missile can be used to perform reconnaissance on the effectiveness of the first missile. The gunner will learn how to judge the effectiveness of a missile hit.

i. Lesson 9 is a full mission simulation, during which the FOG-M gunner can practice all aspects of his job.

OBJECTIVES

Lesson Number: 1 Lesson Title: What is FOG-M?

Topic: B. What is FOG-M?

Topic training time: 60 min. Clas:U

Enabling Objective		Complete
01.	UNDERSTAND FOG-M	X
01.01	STATE WHAT FOG-M IS	X
01.02	STATE WHAT FOG-M DOES	X
01.03	STATE THE MAJOR SUBSYSTEMS OF FOG-M	X
01.04	STATE WHAT IS NOTEWORTHY ABOUT FOG-M	X
01.06	STATE THE CAPABILITIES OF THE FULL FOG-M SYSTEM	X
01.06.01	STATE FUNCTIONAL CAPABILITIES OF THE FULL FOG-M SYSTEM	X
01.06.02	STATE THE EQUIPMENT CAPABILITIES OF THE FULL FOG-M SYSTEM	X
01.07	STATE THE GUNNER SKILLS TO BE TRAINED FOR THE FULL FOG-M SYSTEM	X

COURSEWARE OUTLINE

Lesson Number: 1 Lesson Title: What is FOG-M?

Topic: B. What is FOG-M?

Topic training time: 60 min. Clas:U

Content	Notes
1. Topic introduction frame. Topic 1B describes FOG-M and its capabilities.	
2. Narrative entitled: "What is the FOG-M system?" mentioning the following topics as an overview of FOG-M: a. FOG-M is an anti-tank missile. b. It is linked to a control mechanism via a fiber-optic link. c. It uses a mobile launcher. d. It can be controlled manually or automatically.	Pictures of FOG-M. Diagram of a firing.
3. Narrative explaining what the FOG-M system does: a. It flies to the target propelled by a rocket motor, at X speed. b. It flies using automatic guidance preprogrammed into the computer, or by direct flight commands initiated by the gunner. c. Its range is X km. d. The gunner and the automated programming can e. Manages from 1 to 3 missiles in a salvo	
4. Frame sequence and narrative of the major subsystems of the FOG-M system: a. HMMWV. b Missile launcher. c. Missiles. d. Gunner's console. e. VNAS.	Line drawings of each subsystem.

5. Frame sequence and narrative of the equipment capabilities of the FOG-M system:
a. Vehicle.
b. Vehicle Navigation Aids System (VNAS).
c. Missile.
d. Missile launcher.
e. Gunner's console.
f. Computer.
g. Video Cassette Recorder (VCR).
h. Built-In-Test Equipment (BITE).

6. Frame sequence and narrative of the functional capabilities of the FOG-M system:
a. Definition of "functional capabilities."
b. System mobility.
c. Real-time control by gunner (human-in-the-loop control).
d. Preplanned control via planned mission, using visual correlator or standard flight parameters.
e. Missile range is greater than 5 km.
f. Target attack can come from any angle relative to the target, and various flight paths to the target area can be used.
g. Fiber-optic link is ECM resistant.
h. Reconnaissance capabilities.
i. Missiles can be fired in salvos of 3 missiles, with the lead missile providing guidance to the subsequent missiles.
j. There is a correlator that aids navigation of the missile by comparing a number of "snapshots" of a terrain feature along the missile flight path. These "snapshots" are taken every 2 km, by recording the data sent back by the missile seeker, digitizing it, and storing it in the correlator memory. The comparison of "snapshots" occurs in the following fashion: The first reference "snapshot" is taken just after the missile pitches over from boost to cruise; 2 km later a second picture is taken, digitized, and stored; a computer process compares the two pictures and yields a score stating how well the two pictures seem to match up; 2 km later a third "snapshot" is taken, stored, and compared with the second, and the first "snapshot" is removed from the correlator memory. This procedure is repeated until missile impact.
k. The flight altitude envelope is X meters minimum altitude and Y meters maximum altitude.
l. The system can present a map display of the flight and target areas.

m. Embedded training to sustain gunner skills OJT.
n. Simple user interface.
o. Automatic launch sequence.
p. Can follow a preplanned route and preprogrammed altitude, including turns.

7. Frame sequence and narrative presenting the phases of the FOG-M mission:
a. Planning.
b. Preparation.
c. Move.
d. Deployment.
e. Mission planning on site.
f. Launch.
g. Air navigation (missile).
h. Terminal phase.
i. Impact assessment.
j. Expedient egress.
k. Post-deployment operations.

Discuss activities in each phase. Present one overall graphic to illustrate all phases.

8. Present a simulated FOG-M flight, presenting the video seen via the seeker, along with a verbal narration, using the videotape playback facility or the videodisc.

Audio visual presentation.

9. Frame sequence and narrative of the skills and knowledges required to be a FOG-M gunner.
a. Mission and route planning procedures.
b. Launch procedures.
c. Map reading.
d. System deployment.
e. Land navigation.
f. Manual guidance in cruise.
g. Target recognition, discrimination, prioritization.
h. Ability to relate map to real-time video.
i. Tracking of a target.
j. Emergency and contingency procedures.
k. Impact assessment.

PERFORMANCE MEASUREMENT

LESSON: 1 What is FOG-M?

TOPIC: B. What is FOG-M?

ITEM: 7

Present a simulated FOG-M flight, presenting the video seen via the seeker, along with a verbal narration, using the videotape playback facility or the videodisc.

DISCUSSION: Present gunner with simulated FOG-M cruise. The cruise must be narrated for the gunner. There are no other special requirements for this item. Verbal narration and visual presentation.

EQUIPMENT REQUIRED: Dynamic video presentation of a missile cruise, narration of the cruise presented on the screen.

GUNNER REQUIRED ACTION: Observe CRT to watch seeker video and to read narration.

PERFORMANCE MEASUREMENT: No measurement is performed during this item. The presentation is subdivided so the trainee can pace it by pressing a key to continue.

PERFORMANCE MEASURES: None.

OBJECTIVES

Lesson Number: 2 Lesson Title: FOG-M Equipment Summary

Topic: FOG-M Equipment Summary

Topic training time: 30 min. Clas: Confidential (flight data)

Enabling Objective		Complete
04.	UNDERSTAND AND RECOGNIZE FOG-M EQUIPMENT, UNDERSTAND FUNDAMENTAL FOG-M PARAMETERS	X
04.01	STATE THE FUNDAMENTAL PARAMETERS OF THE FOG-M DEMONSTRATION	X
04.02	STATE LOCATIONS OF ALL CONTROLS THAT ADJUST SEEKER VIDEO	X
04.02.01	STATE ADJUSTMENTS TO BE MADE TO SEEKER VIDEO	X
04.03	STATE THE CONTROLS THAT CONTROL ALTITUDE, PITCH, ROLL, AND AZIMUTH (YAW).	X
04.04	STATE THE FUNCTIONS REQUIRED TO OPERATE THE DEMONSTRATION FOG-M SIMULATED MISSILE	X
04.05	NAME EACH CONTROL AND DISPLAY ON THE FOG-M CONSOLE AND STATE IT FUNCTION	X
04.05.01	NAME EACH CONTROL AND DISPLAY ON THE FOG-M CONSOLE	X
04.05.02	STATE THE FUNCTION OF EACH CONTROL AND DISPLAY ON THE FOG-M CONSOLE	X

COURSEWARE OUTLINE

Lesson Number: 2 Lesson Title: FOG-M Equipment Summary

Topic: FOG-M Equipment Summary

Topic training time: 30 min. Clas:Confidential (flight data)

Content	Notes
1. Lesson introduction frame and narrative, estimated time, and narrative of topics to be covered. Lesson 2 summarizes the hardware of FOG-M.	
2. Frame sequence and narrative stating the fundamental operating parameters of the FOG-M. a. Fiber-optic guided missile system. b. Fiber-optic system connected to a video camera (seeker) capable of sending back real-time video for use in manual or automated guidance. c. Usually employed against armored targets. d. Range of X km. e. Flight speed about X km/hr. f. 12 missiles per launcher. g. Capable of automated navigation direct to a set of coordinates, or following a preplanned route containing up to 3 waypoints. h. Capable of storing digitized video terrain data to be used by an automated visual correlator that checks previously stored terrain features to double check that the missile is on the expected route. In this demonstration FOG-M system, this information can only be used to keep the missile on a straight flight path. i. Capable of storing a videotape record of a flight for later use in impact assessment or reconnaissance.	
3. Frame sequence discussing the basic functions required to operate the demonstration FOG-M system: a. Full operation will start at the launch phase, with mission planning already built in. b. Gunner will monitor missile during automatically guided cruise, or will guide missile manually.	Graphic naming the phases. The phases that are not to be taught should be in a different background color.

c. Gunner will detect/select targets using video from the missile, possibly under adverse conditions.

Show a line drawing of the missile flying over several target areas with one target selected.

d. Gunner will perform lock-on to a target or will elect to guide missile to target manually.

Show the cross hairs on a tank.

e. Gunner will have the opportunity to assess missile impact using seeker video recording.

4. Frame sequence pointing out the controls and displays on the gunner's console, along with their use:

Line drawing of the console, with each item highlighted as it appears.

a. CRT/Display--Information output and video display output.
b. Contrast and brightness thumbwheels--Adjust contrast and brightness of CRT.
c. Mode selector--Selects operating, maintenance, or training modes.
d. Power switch/indicator--Applies power to FOG-M and indicates whether power is available.
e. Joystick--Allows gunner to control missile seeker and missile flight attitudes.
    i. MAN/AUTO NAV--Selects whether the missile will fly via manual or automatic control. In AUTO the controls move the seeker but not the missile itself; in MAN the controls move the seeker and the missile follows suit.
    ii. Center 4-way switch on main joystick--Pitches seeker or missile up and down. Slews seeker or missile left and right.
    iii. Right side toggle--Increases/decreases zoom from greatest to lowest magnification.
    iv. Trigger--Initiates lock on to a target.
f. Panel light control--Adjusts panel light level.
g. Advance Subfunction key--Selects an alternative response to the computer from the one offered by the programmable display pushbuttons.
h. Programmable display pushbuttons (PDPs)--Display messages and enter responses during mission planning and launch sequences.
i. Firing switch--Launches the missile.
j. ALT INCR/ROLL 4-way switch--Increases/decreases altitude and rolls missile clockwise and counterclockwise.

k. REC M switch--Records video display data on video recorder for 30 sec.
l. ALT DISP--Alternates CRT display between seeker video and map display.
m. CHNG MAP--Allows selection of a new map display.
n. Iris controls.
    i. IRIS OPEN and CLOSED buttons--Manually opens/closes seeker iris.
    ii. IRIS AUTO/MAN--Toggles between automatic and manual iris control.
o. ZOOM--Zooms the seeker from lowest to greatest magnification.
p. TRK B/W and TRK W/B--Selects whether the video display is white-on-black or black-on-white.
q. Keypad--Used for numeric data entry.

OBJECTIVES

Lesson Number: 3 Lesson Title: Launch

Topic: A. Familiarization and Background

Topic training time: 30 min. Clas:U

Enabling Objective		Complete
05.	PERFORM LAUNCH PROCEDURES	
05.01.01	SELECT LAUNCH FUNCTION	
05.01.02	CONFIRM OR CORRECT EXISTING LAUNCHER DATA (LAUNCH SITE, LAUNCHER HEADING)	
05.01.03	ENTER MISSILE GUIDANCE DATA (MISSION TYPE, TARGET NUMBER, ROUTE NUMBER, TARGET COORDINATES, MISSILE HEADING AND AZIMUTH)	
05.01.03.01	DETERMINE MISSION TYPE	
05.01.03.02	OPERATE PDP'S	X

COURSEWARE OUTLINE

Lesson Number: 3 Lesson Title: Launch

Topic: A. Familiarization and Background

Topic training time: 30 min. Clas:U

Content	Notes
1. Lesson introduction frame, estimated time, and narrative of topics to be covered. Topic 3A presents the knowledges necessary to perform a launch.	
2. Narrative explaining launch of missile. a. Gunner must tell the system where it is located (launcher data). b. Gunner must tell the system where it will be firing the missile (guidance data). c. Gunner must tell the system how it will reach the target (guidance data). d. The missile can be launched once all the data have been checked and/or entered.	
3. Frame sequence and narrative of general instructions about PDP use: a. The PDPs are used only during the launch sequence.	Show the PDPs on the gunner's console.
b. A PDP can light up with different messages, depending on the particular place in the launch sequence that the system is.	Light up an actual PDP.
c. Sometimes the PDP just lights up, to tell the gunner that the system has reached that step in the procedure.	
d. Sometimes the PDP lights up and flashes and also presents information on the video display. The gunner may press the flashing PDF to continue, thereby accepting the data, or he may follow another procedure to alter the data.	Flash a PDP.
e. Sometimes the PDP lights up and flashes and must simply be pressed to continue the sequence. f. The Advance Subfunction key takes the operator to special procedures, such as data correction.	

4. Narrative explaining launch procedures:
a. Select launch function.
    i. Launch initialization.
    ii. Launcher data input.
b. Select mission type.
    i. Preset route.
    ii. Fire on coordinates.
    iii. Fire on azimuth.
c. Select missile.
d. Mission activation.
e. Automatic pre-launch, countdown, launch sequence, with abort capability.

5. Frame sequence and narrative of the name of each step and a brief description of what happens (or the information required) during the step. The steps are:
a. Launch initialization.
b. Launcher data input.
c. Mission type selection.
d. Preset route mission definition.
e. Target coordinate mission definition.
f. Target azimuth mission definition.
g. Missile selection.
h. Mission activation.
i. Pre-launch.
j. Countdown.
k. Launch.
l. Abort.
m. Advance Subfunction key.

OBJECTIVES

Lesson Number: 3 Lesson Title: Launch

Topic: B. Launch Procedures

Topic training time: 60 min. Clas:U

Enabling Objective		Complete
05.	PERFORM LAUNCH PROCEDURES	X
05.01	FIRE MISSILE (ABORT, HOLD, OR LAUNCH)	X
05.01.01	SELECT LAUNCH FUNCTION	X
05.01.01.01	STATE LAUNCH SELECTION PROCEDURE	X
05.01.02	CONFIRM OR CORRECT EXISTING LAUNCHER DATA (LAUNCH SITE, LAUNCHER HEADING)	X
05.01.03	ENTER MISSILE GUIDANCE DATA (MISSION TYPE, TARGET NUMBER, ROUTE NUMBER, TARGET COORDINATES, MISSILE HEADING AND AZIMUTH)	X
05.01.03.01	DETERMINE MISSION TYPE	X
05.01.04	CONFIRM THAT ENOUGH MISSILES ARE AVAILABLE FOR MISSION	X
05.01.05	SELECT CORRELATOR IF DESIRED	X
05.01.06	LAUNCH MISSILE	X
05.02	RESPOND TO SELECTED MAJOR CONTINGENCIES FOR MISSILE LAUNCH	X
05.02.01	STATE MAJOR CONTINGENCIES DURING MISSILE LAUNCH	X
05.02.02	ABORT LAUNCH OF MISSILE	X
05.02.03	RESPOND TO FAILURE OF MISSILE TO FIRE	X
05.02.03.01	STATE RESPONSE TO FAILURE OF MISSILE TO FIRE	X
05.02.04	STATE RESPONSE TO HUNG MISSILE	X

COURSEWARE OUTLINE

Lesson Number: 3 Lesson Title: Launch

Topic: B. Launch Procedures

Topic training time: 60 min. Clas:U

Content	Notes
1. Topic introduction frame, estimated time, and narrative of topics to be covered. Topic 3B will teach how to launch the FOG-M and will take the trainee through a launch.	
2. Frame sequence and narrative of launcher data input, and its units. a. Launch site -- UTM coordinates b. Launcher heading -- degrees magnetic	
3. Data correction Advance Subfunction key procedure. Use when: a. The data within some procedures are incorrect. A PDP is flashing, but the operator does not want to submit this incorrect data to the system; or b. You do not want to select the correlator. c. Procedure: i. Press the Advance Subfunction key to enter the data correction sequence. ii. Enter the correct data in place of the incorrect data. iii. Press the flashing PDP. This flashing PDP may be "TGT OK?", "COORDS OK?", AZ OK?", or "ROUTE OK?", depending on the particular sequence where the incorrect data appeared.	
4. Frame sequence and narrative of mission type data input display and data that will be required. a. Three PDPs are flashing: i. "PRESET ROUTE" -- Map, route, and target number. ii. "TARGET COORDS" -- UTM coordinates. iii. "TARGET AZ" -- Degrees. b. Preset route data procedure: i. Press "PRESET ROUTE" PDP. ii. Verify map number and press "MAP OK?" PDP if the map number is correct.	Show the PDPs actually lit up as the procedure progresses.

iii. Verify target number and press "TGT OK?" PDP if the target is the right one.

iv. Verify route number and press "RTE OK?" PDP if the route is correct.

v. Use Advance Subfunction key procedure if data are incorrect; use "RETRY" PDP if data are rejected but operator feels that they are correct.

c. Fire on coordinates procedure:

i. Press "TARGET COORDS" PDP.

ii. Press "COORDS OK?" PDP if coordinates are correct.

d. Fire on azimuth data:

i. Press "TARGET AZ" PDP.

ii. Press "AZ OK?" PDP if azimuth data are correct.

5. Restart sequence:

The operator can start the pre-launch sequence over from the beginning of the launch sequence at any time by pressing the "LAUNCH CONTRL" PDP. This is necessary when the operator that previously input and confirmed data are incorrect, such as an incorrect map, or even an incorrect mission selection. The operator must be careful only to press this PDP if he wants to restart, because an incorrect press will require that all data be input again, wasting time.

Light the appropriate PDPs and have the gunner press the correct one to proceed.

6. Frame sequence and narrative of whether to use the correlator.

a. Discussion of what the correlator does:

i. Records a key terrain feature along the route from the seeker video of the lead missile.

ii. Compares stored terrain feature data to the seeker video from subsequent missiles in the salvo, or from the same missile at a later point in the flight.

iii. Stored correlator data is salvo specific and is cleared upon selection of the next mission salvo.

b. For the demonstration system only one missile may be fired per salvo.

c. The correlator can be selected on any type of mission.

d. The particular set of correlator data is unique to the specific mission salvo. After the last missile in the salvo has been fired and impacts, the correlator memory is automatically cleared of correlator data from that mission.

e. For the first missile on which the correlator is selected, FOG-M will fly the mission route and record a prominent terrain feature for subsequent use by that missile or by other missiles in the same salvo.

7. Frame sequence and narrative of procedure to select number of missiles and the correlator.
a. Typical use of correlator in the full FOG-M will be to keep missiles in a salvo all following the lead missile.
b. The correlator is usable when a multimissile salvo provides data from the first missile for subsequent missiles, or when a prominent feature (e.g., a large mountain behind the target area) can be used as a reference point several times during the flight of a single missile.
c. Once the mission type is specified a PDP will light up with the message "ENTER # MSLS", and a second PDP lights up and flashes with the message "XX MSL OK?". Press the flashing PDP if the number of missiles is correct; use the Advance Subfunction key routine to change the number of missiles if it is not.

Light up the appropriate PDPs and have the gunner press the correct PDP to proceed.

d. Once the number of missiles has been verified or changed, the correlator selection procedure begins. A flashing PDP labelled "USE CORR?" will appear. Press it to select the correlator. Use the Advance Subfunction key procedure to execute a mission without the correlator.

Remind the gunner about the presence of the Advance Subfunction key.

e. The next action will initiate the launch.

8. Frame sequence and narrative explaining the launch procedures.
a. Once the correlator selection has been made, the mission activation (launch) procedures begin. A PDP will light and flashes with the message "RDY TO LAUNCH", and a second PDP lights up and flashes with the message "ABORT MISSN". Press the "RDY TO LAUNCH" flashing PDP.

Light up the appropriate PDPs and have the gunner press the correct PDP to proceed.

b. Press the flashing "RDY TO LAUNCH" PDP to place the system in the pre-launch mode. The pre-launch mode is identified by the lighted PDP, display as follows--"LAUNCH CONTROL", "PRE-LAUNCH", "ENABLE FIRE", and a fourth PDP, flashing, with the message "ABORT MISSN". The "ENABLE FIRE" PDP indicates that the missile and system are OK for firing to proceed.

c. The gunner activates the FIRE switch and the missile countdown begins. At the end of the countdown, the missile fires automatically and the "MSL IN FLIGHT" PDP lights.

Show the actual sequence. Have the gunner use the correct switch.

9. Frame sequence and narrative explaining the procedure to exit the launch mode or to abort the launch.
a. Press the "LAUNCH CONTRL" PDP to:
i. Activate the abort process.
ii. Deactivate and power down the missile.
iii. Return the system to the operational mode for system task selection.
b. Press the "ABORT MISSN" PDP to:
i. Abort the current mission without exiting launch control.
ii. Return the system to the mission type selection phase (preset, fire on coordinates, or fire on azimuth).

Do not light the PDPs for this presentation. The presentation is generic, and the gunner should not associate it with one set of PDPs.

10. Narrative explaining the major contingencies associated with missile launch:
a. Failure of the missile to fire.
b. Hung missile.

11. Narrative explaining the response procedures for the major contingencies associated with missile launch.
a. Procedures to respond to the failure of the missile to fire:
i. Attempt again to fire the missile.
ii. System skips the faulty missile automatically.
iii. Fire the next missile.
b. Procedures to respond to a hung missile:
i. Open circuit breaker.
ii. Remove hung missile from launcher.
iii. Close circuit breaker.
iv. Fire next missile.

COURSEWARE OUTLINE

Lesson Number: 3 Lesson Title: Launch

Topic: C. Launch Procedures Test

Topic training time: 30 min. Clas:U

Content	Notes
1. Present the following situations and have the student select the next step in the sequence: a. The target coordinates are XXXXXX, stated at the top of the frame. The frame shows the correct PDP display with the "COORDS OK?" PDP shown as coordinate data as YYYYYY, where YYYYYY is clearly not the same as XXXXXX. The subject is given the choice of the following steps: i. Press the "LAUNCH CONTRL" PDP. ii. Press the "TARGET COORDS" PDP. iii. Press the "COORDS OK?" PDP. iv. Press the Advance Subfunction key. b. The gunner is told that he entered a target aximuth of YYY. This is on the screen, but the system says that it is invalid. Show the flashing "RETRY" PDP. The gunner selects the next step: i. Press the "LAUNCH CONTRL" PDP. ii. Press the "TARGET AZ" PDP. iii. Press the "INVALD AZ" PDP. iv. Press the "RETRY?" PDP. v. Press the Advance Subfunction key.	For the following questions, light up the PDPs that are choices and remind the gunner that the Advance Subfunction key is also a possible choice. For each question, prompt the gunner to make a selection. Selection must be made within 30 seconds. If selection is not made in the required time, the system prompts the gunner to retry or to continue to the next scenario. If the gunner makes an incorrect selection, the system cues the gunner that his selection was incorrect and to retry. If the second selection is incorrect, the system records the error and cycles to the next scenario. At the end of the test, the gunner is scored. If the gunner's score is below 75 percent, the gunner is cued and retakes the unsatisfactory (error) portions of the test.

c. The frame sequence and narrative says that you have entered the number of missiles and have pressed the "XX MSLS OK?" PDP. The following PDPs appear. Your next action is:

i. Press "LAUNCH CONTRL" PDP.
ii. Press "SELECT MSLS" PDP.
iii. Press "USE CORR?" PDP.
iv. Press "ABORT MISSION".
v. Press Advance Subfunction key.

d. Which of the following switches will cancel a flashing PDP and allow changing data?

i. "LAUNCH CONTRL" PDP
ii. Advance Subfunction Key.
iii. "RETRY?" PDP.
iv. "ABORT MISSN" PDP.

Do not light the PDPs for this question. This is not a normal PDP choice selection.

e. You are given a fire mission by radio to engage a target at coordinates ZZZZZZ. You have not planned any fire to that area prior to this time. The "PRESET ROUTE", "TARGET COORDS", AND TARGET AZ" PDPs are flashing. What is your next action?

i. Press "LAUNCH CONTRL" PDP.
ii. Press "PRESET ROUTE" PDP.
iii. Press "TARGET COORDS" PDP.
iv. Press "TARGET AZ" PDP.
v. Press the Advanced Subfunction key.

f. The gunner has completed the correct procedure to fire a preset route mission, up through the selection of the correlator. "READY TO LAUNCH" and "ABORT MISSN" PDPs are flashing. Which of these is the correct next step?

i. Press "LAUNCH CONTRL" PDP.
ii. Press "RDY TO LAUNCH" PDP.
iii. Press "ABORT MISSN" PDP.
iv. Press the Advance Subfunction key.

g. Which PDP requests input of target number, route number, number of missiles?

i. "LAUNCH CONTROL".
ii. "PRESET MISSION".
iii. "TARGET COORDS".
iv. "TARGET AZ" .

Question h should not show the PDPs lit, since these are not real PDP selections.

h. Frame and narrative states that the gunner has selected the flashing "USE CORR?" PDP. The next action is:

i. Press the "LAUNCH CONTRL" PDP.
ii. Press the "RDY TO LAUNCH" PDP.
iii. Press the "ABORT MISSN" PDP.
iv. Press the Advance Subfunction key.

i. Frame and narrative states that the gunner has selected the "RDY TO LAUNCH" PDP. Which lighted PDP tells the gunner the missile is ready to fire?

i. "LAUNCH CONTRL" PDP.
ii. "PRE-LAUNCH" PDP.
iii. "ENABLE FIRE" PDP.
iv. "ABORT MISSN" PDP.

PDPs OK for this question. This is an actual PDP selection.

j. Frame and narrative states that while in the launch mode the gunner wishes to return the system to the operational mode, the next action should be:

i. Press the "LAUNCH CONTRL" PDP.
ii. Press the "PRE-LAUNCH" PDP.
iii. Press the "ABORT MISSN" PDP.
iv. Press Advance Subfunction key.

(Note to training developer: The "LAUNCH CONTRL" PDP returns the system to the start of the launch control sequence so that the correct map may be selected at the appropriate point.)

k. Frame and narrative states that in order to abort the current mission without exiting the launch control mode, the gunner should press which switch?

i. "LAUNCH CONTRL" PDP.
ii. "ABORT MISSN" PDP.

l. Frame and narrative states that the gunner has completed mission activation by pressing the flashing "RDY TO LAUNCH" PDP. The "ABORT MISSN" PDP is flashing. The next action to take to fire the missile is:

i. Press the "LAUNCH CONTRL" PDP.
ii. Press the "PRE-LAUNCH" PDP.
iii. Press the "ENABLE FIRE" PDP.
iv. Press the "ABORT MISSN" PDP.
v. Toggle the FIRE switch.

m. Frame and narrative states that after the countdown is complete the missile does not fire. It has partically exited the launcher. The next action is:

i. Open the circuit breaker.
ii. Remove hung missile.
iii. Close circuit breaker.
iv. Fire next missile.
v. <u>All of the above in order</u>.

2. Present a simulated launch sequence. The gunner receives instructions step-by-step on the video display, and should make the correct responses. Mission information should remain on the screen during scenario activity. If this is not feasible, advise the gunner to make paper and pencil notes. The following scenarios are presented:

Use the actual PDPs. The system must somehow present and maintain the data on the CRT screen.

a. Launch a missile on azimuth = xxx, no correlator.
b. Launch a missile on coordinates - xxx, no correlator.
c. Launch a missile on a preset route. Route number = xxx; map number = yyy; target number = zzz, no correlator.
d. Launch a missile on azimuth yyy; select correlator.
e. Launch a missile on a preset route from the launch initialization step. Launcher site coordinates = dddddd; launcher heading = fff degrees; target route number = ggg; map = hhh; target number = kkk; use correlator.
f. Launch a missile on azimuth = xxx from the launcher data input step. Launcher coordinates = yyyyyy; launcher heading = zzz; no correlator.
g. Launch a missile on a preset route. Route number = xxx; if this is invalid, use route number = www. Map number = zzz; select correlator. Target number xxx should be invalid.
h. Launch a missile to coordinates = yyy; no correlator. Use map number zz if coordinates are invalid. The coordinates should be invalid because they are off the current map. The gunner must press the "LAUNCH CONTRL" PDP to return to the beginning of the launch control procedure, and he must enter the new map number at the appropriate place in the launch sequence.
i. Given a fire mission to launch a missile on azimuth = xxx to engage an enemy tank, complete the procedures to launch the missile. No correlator.

This item is expanded in a Performance Measurement page at the end of Lesson 3. If the gunner makes a procedural error, the system prompts him to retry. If the error is repeated, the system records the error and cycles to the next scenario. At the end of the scenarios, the gunner is scored. If the gunner's score is at the 50 percent level, he is cycled back to review the "Launch Procedures" topic of the lesson. Upon completing the review of the "Launch Procedures" topic, the gunner will redo the simulated lauch test until a 75 percent level of competency is reached. If the gunner's score is at the 75 percent level, the system cycles the gunner back to retake

the unsatisfactory (error) portions of the test. At each recycling, the gunner has the choice of proceeding forward instead of recycling.

j. Given a fire mission to fire a preset route mission, complete the procedure to launch the missile. Mission information is--launcher coordinates = uuuuuu, launcher heading = vvv degrees, target route number = ww, map number = xxxxx, and target number = yyy. No correlator.

k. Given a fire mission to engage an enemy tank that is refueling at coordinates = xxxxxx, complete the procedures to launch the missile. No correlator.

PERFORMANCE MEASUREMENT

LESSON: 3 Launch

TOPIC: C. Launch Procedures Test

ITEM: 2

Present a simulated launch sequence. The gunner receives instructions step-by-step on the video display, and should make the correct responses. Mission information should remain on the screen during scenario activity. If this is not feasible, advise the gunner to make paper and pencil notes.

DISCUSSION: In this item the gunner performs various mission launch procedures. The PDPs used during this procedure act and react in the same way as they do for the operational system. Listed below are the launch sequences:

a. Launch a missile on a specified azimuth. No correlator, azimuth and one (1) missile selection are entered by gunner.

b. Launch a missile to specified coordinates. No correlator, coordinates and one (1) missile selection are entered by gunner.

c. Launch a missile on a planned route. No correlator; map number, target number, route number, and one (1) missile selection are entered by the gunner.

d. Launch a missile on a specified azimuth. Correlator, azimuth and missile selection are entered by gunner.

e. Launch a missile on a preset route. Use correlator; launcher site coordinates, launcher heading, map number, target number, route number, and missile are entered by the gunner.

f. Launch a missile on a specified azimuth. No correlator. Launcher coordinates, launcher heading, and azimuth are entered by gunner.

g. Launch a missile on a preset route number; however, this route number will be invalid. When the gunner is shown the PDPs for an invalid route number, he is prompted to enter another route number that is valid as well as the map number and two (2) missile selection. Use the correlator.

h. Launch a missile to specified coordinates. The coordinates are not on the current map and should cause the PDPs for invalid coordinates to be displayed. An explanation about why the

coordinates were invalid is presented and the gunner is instructed to cycle back to the launch initialization step. A new map number and coordinates are entered by the gunner as well as one (1) missile selection.

i. Launch a missile on a specified azimuth. The gunner will receive a complete set of data for the launch. The data are included in a brief mission description. The fire mission is to be directed on a target known to be on the azimuth.

j. Launch a missile on a preset route. Launch data is presented in the fire mission briefing. The mission is the same as in i. except on a preset route.

k. Launch a missile to specified coordinates. Launch data is presented in a fire mission briefing. The fire mission is to launch a missile on a target refueling at the specified coordinates.

All of the launch data are presented to the gunner in a prompt at the beginning of the launch procedures, along with a short description of the type of launch procedure. This prompt remains on screen for the entire launch procedure. Items i, j, and k require a short fire mission description.

The data entered are compared to the correct data. An error stops the launch immediately and the gunner reenters the data. The system records error as a data entry error. A second error causes the system to enter the data correctly. Figure A-3.1 illustrates this process.

If the incorrect PDP is pressed or the Advance Subfunction switch is pressed at the wrong time, the gunner is corrected immediately. If a a second error occurs, the system tells the gunner which switch to press. The error is recorded. Figure A-3.2 illustrates the PDP/Advance Subfunction selection process.

Only PDP and the Advance Subfunction switch inputs are considered for correctness. Other switches and buttons have no effect. For example, if the gunner is supposed to press a PDP or the Advance Subfunction switch, but he presses a data entry key, the system does nothing.

These error routines are presented in the accompanying flow charts (Pages A-32 and A-33). An error, data entry or PDP/ADVANCE Subfunction switch selection, causes the system to record that particular launch procedure as having errors. At the end of each launch sequence the number of data entry errors and PDP/ADVANCE Subfunction switch errors are reported, along with the number corrected by the gunner. After all the launch procedures have been practiced, the system will give feedback accumulated during the training session, including: total errors for each type, data entry or PDP/ADVANCE Subfunction selection; number of errors corrected by the gunner; and launch procedures recommended for further practice.

PERFORMANCE MEASUREMENT

EQUIPMENT REQUIRED: PDPs that function as in the operational system, Advance Subfunction switch, launch switch, and video screen.

GUNNER REQUIRED ACTION: Perform launch procedure.

PERFORMANCE MEASUREMENT: The gunner is measured on ability to follow the correct sequence of steps for each type of launch sequence. PDP/ADVANCE Subfunction switch steps are checked to verify that they are correct, and entered data are checked to verify that they are correct. Incorrect steps are recorded as basic error types, either data entry or PDP/ADVANCE Subfunction switch, and the launch sequence is recorded as having errors.

PERFORMANCE MEASURES:

1. Switch operations

    a. PDPs
    b. Advance Subfunction switch

2. Data entry using alphanumeric keypad

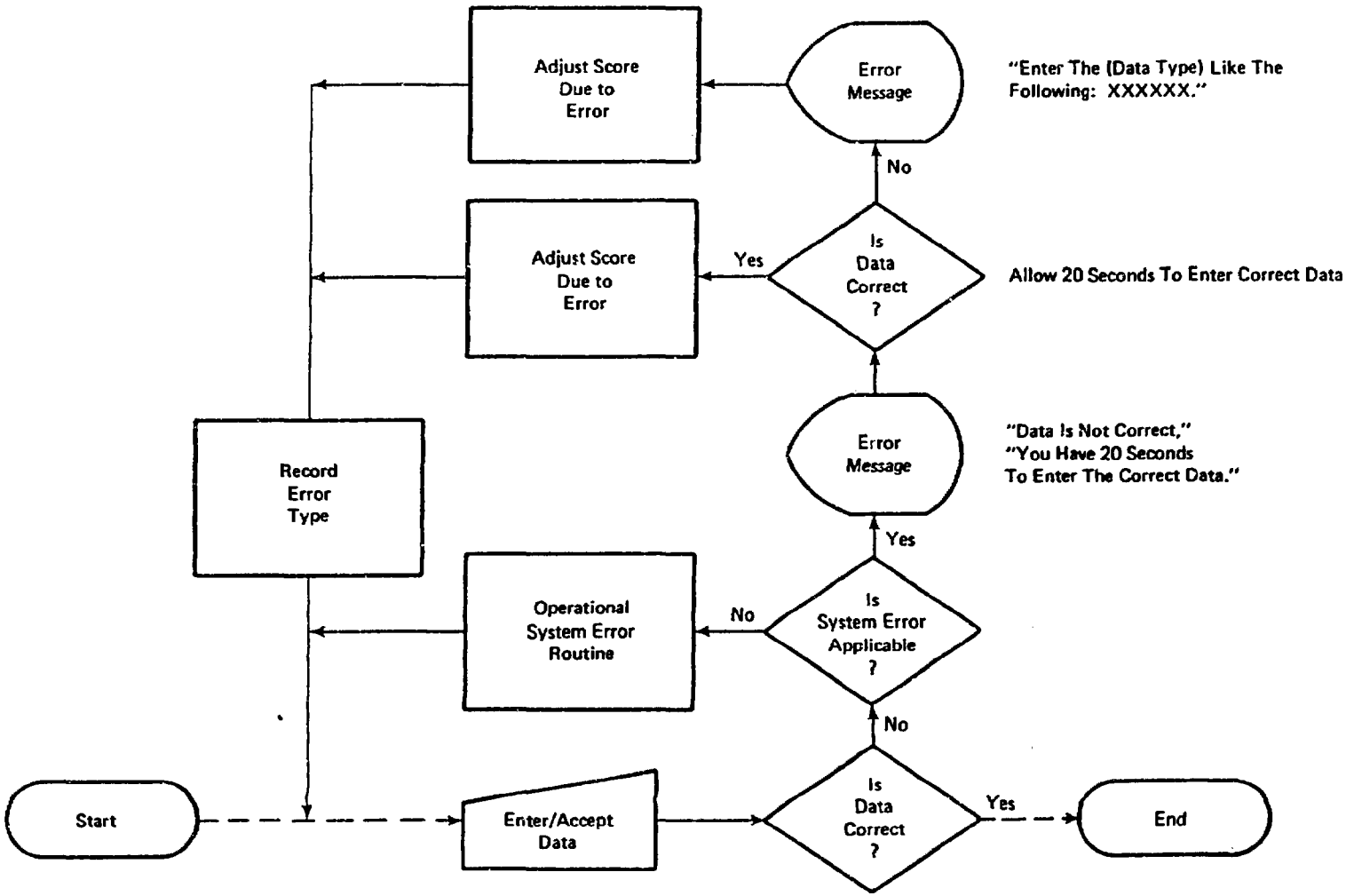

Figure A-3.1 Data Entry Selection Model

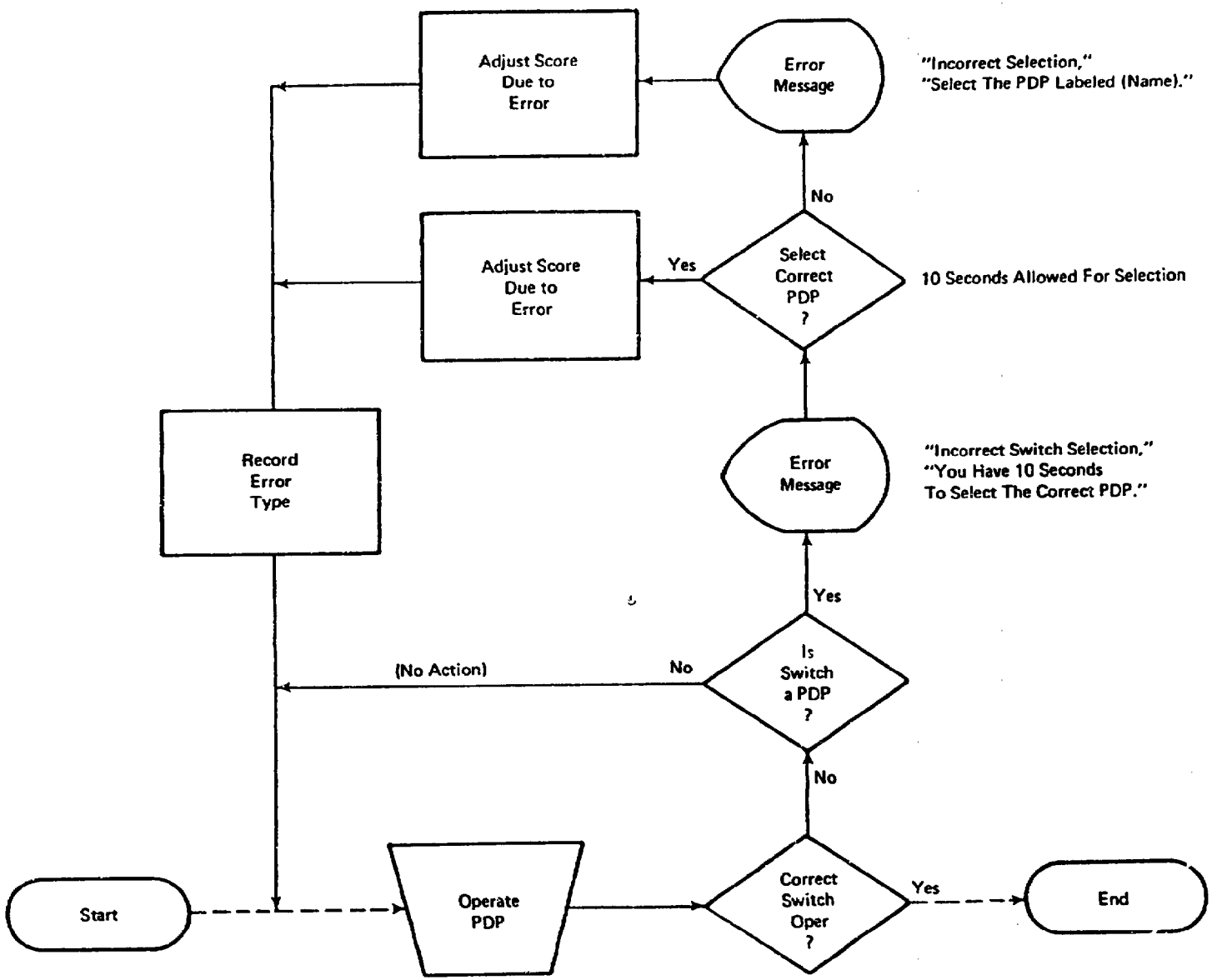

Figure A-3.2 PDP/ASF Selection Model

OBJECTIVES

Lesson Number: 4 Lesson Title: Using the Seeker

Topic: Using the Seeker

Topic training time: 30 min. Clas:U

Enabling Objective		Complete
06.	USE THE SEEKER	X
06.01	ADJUST SEEKER VIDEO	X
06.01.01	ADJUST BRIGHTNESS AND CONTRAST OF VIDEO DISPLAY	X
06.01.02	SELECT APPROPRIATE SEEKER IRIS DIAMETER	X
06.01.02.01	STATE ACTIONS TO TAKE WHEN SEEKER IRIS ADJUSTMENT FAILS	X
06.02	OPERATE SEEKER SLEW TO OBSERVE FEATURES	X
06.02.01	MAINTAIN KNOWLEDGE OF ORIENTATION OF SEEKER VS. MISSILE WHILE SEEKER IS SLEWED	X
06.02.02	SLEW SEEKER TO CENTER THE TARGET AREA ON THE VIDEO DISPLAY	X
06.02.03	STATE ACTIONS TO TAKE WHEN SEEKER DOES NOT SLEW	X
06.03	OPERATE SEEKER ZOOM	X
06.03.01	STATE ACTIONS TO TAKE WHEN SEEKER ZOOM FAILS	X

COURSEWARE OUTLINE

Lesson Number: 4 Lesson Title: Using the Seeker

Topic: Using the Seeker

Topic training time: 30 min. Clas:U

Content	Notes
1. Lesson introduction frame, estimated time, and narrative topics to be covered. Lesson 4 teaches aiming, iris control, and zoom control for the seeker.	
2. Frame sequence and narrative about seeker layout, presenting: a. Physical layout and range of motion of the seeker inside the missile. b. Demonstration of seeker range of motion. c. Relationship of seeker video to the flight path of the missile. Present motion video, rather than still scenes. i. Centered forward. ii. Down. iii. Left and right. d. Demonstration of seeker iris operation. e. Demonstration of seeker zoom operation.	Line drawing of the seeker inside the missile. Show range of motion of the seeker.
3. Frame sequence and narrative about seeker control, presenting: a. Location of the seeker slew, zoom, and iris controls. b. Function of each control. c. Operating procedures for each seeker function.	
4. Computer generated graphic and narrative showing the outside view of the missile and seeker. The gunner practices moving the seeker around by using the actual seeker controls on the joystick.	Moving graphic that shows the movement of the seeker in response to the joystick controls. Control/display fidelity is crucial. Allow the gunner to practice until he is satisfied with his performance.

5. Frame sequence and narrative discussing consequences and action to take under the following contingencies:
a. Failure of seeker to slew.
b. Failure of seeker to zoom.
c. Failure of seeker iris control.

6. Simulated seeker view. Performance simulation to practice seeker slew, zoom, and iris operation. The task is to mark items that appear on the seeker video, using the cross hairs and joystick trigger. Present the following scenarios:
a. Nonmoving simulated scene with varied scene brightness. Recommend that the gunner observe the effect of varying video brightness and contrast by using the CRT controls, as well as by using the iris control.
b. Simulated FOG-M cruise, varying the following scene parameters:
   i. Cruise speed.
   ii. Brightness of scene.
   iii. Location of items of interst.
   iv. Number of items of interest.

Actual seeker controls operate the seeker and control the seeker view. The gunner should be able to skip forward without completing practice. If possible, the gunner should have the opportunity to choose which type of practice he wishes to perform.
Ten (10) objects per flight.
Allow repeated practice at the gunner's discretion.
This item is expanded in Performance Measurement pages at the end of Lesson 4.

PERFORMANCE MEASUREMENT

LESSON: 4 Using the Seeker

TOPIC: Using the Seeker

ITEM: 6a.

Simulated seeker view. Performance simulation to practice seeker slew, zoom, and iris operation.

a. Nonmoving simulated scene with varied scene brightness. Recommend that the gunner observe the effect of varying video brightness and contrast by using the CRT controls, as well as by using the iris control.

DISCUSSION: The gunner is given still seeker video with a target in heavy shadows, and is instructed to observe the effects of BRIGHTNESS/CONTRAST and iris controls on the video, and how they can aid detection of a target. The gunner is prompted to increase and decrease the video brightness, increase and decrease video contrast, and open and close the seeker iris. The gunner is also prompted to use the seeker slew and zoom controls. This is followed by a period of full adjustment.

EQUIPMENT REQUIRED: Still video with a target in heavy shadows; brightness/contrast, iris, slew, and zoom controls.

GUNNER REQUIRED ACTION: Respond to prompts to adjust video, iris, slew, and zoom controls.

PERFORMANCE MEASUREMENT: This is an interactive item designed to familiarize the gunner with the video/seeker controls. No performance measures are required.

PERFORMANCE MEASURES: None

PERFORMANCE MEASUREMENT

LESSON: 4 Using the Seeker

TOPIC: Using the Seeker

ITEM: 6b.

Simulated seeker view. Performance simulation to practice seeker slew, zoom, and iris operation.

b. Simulated FOG-M cruise, varying the following scene parameters:
   i. Cruise speed.
   ii. Brightness of scene.
   iii. Location of items of interest.
   iv. Number of items of interest.

DISCUSSION: This is a 60 second simulated missile cruise. During this cruise the gunner must locate and mark ten (10) targets along the cruise route. Some targets are in the open and some are in shadows of varying density. Targets are also at varying distance from the seeker so the gunner uses the slew and zoom controls. Each target is marked by centering the seeker cross hairs on the target and pulling the trigger. All objects not marked are counted as errors and recorded for feedback. Each object should be rated with a high, medium, or low level of difficulty so this can be part of the feedback. Feedback consists of the number of targets marked and missed, and how many were hard to see, fairly hard to see, and easy to see. Feedback is given after each simulated cruise. At the end of three (3) simulated missile cruises a summary of feedback from the three (3) cruises is presented. The gunner is given the option to practice further or to continue.

EQUIPMENT REQUIRED: Dynamic video with ten (10) target objects in varying shadow densities; Video brightness/contrast controls; seeker iris, slew, and zoom controls.

GUNNER REQUIRED ACTION: Locate and mark 10 targets during a 60 second simulated cruise.

PERFORMANCE MEASUREMENT: Each missile cruise simulation is evaluated to see if the ten (10) targets are marked. Feedback occurs at the end of each simulated missile cruise, to include targets missed and their difficulty ratings. After three (3) missile cruise simulations, composite feedback of the last three (3) missile cruise simulations is presented.

PERFORMANCE MEASURES:

1. Whether a target on a dynamic video display is marked by the trigger depression (requires that the target be a defined area of the screen).

2. Number of targets marked correctly.

3. Number of targets marked incorrectly.

4. Specific targets missed (not marked).

7. Seeker slewing practice using geometric figures. Several geometric figures may be present in a single scenario. The gunner practices slewing the seeker cross hairs onto a particular geometric figure and maintaining the cross hairs on the figure for five seconds. a. Fixed size target, nonmoving. b. Target that enlarges, indicating time elapsed; nonmoving. Fixed amount of time to center cross hairs. c. Fixed size target, moving. d. Enlarging target, moving. Fixed amount of time to center cross hairs.	Present a graphic showing how long the gunner has maintained the cross hairs on the current figure. Allow repeated practice until the gunner can maintain the cross hairs on the object for the full time. This item is expanded in a Performance Measurement page at the end of Lesson 4.

PERFORMANCE MEASUREMENT

LESSON: 4 Using the Seeker

TOPIC: Using the Seeker

ITEM: 7

Seeking slewing practice using geometr · figures. Several geometric figures may be present in a single scenario. The gunner practices slewing the seeker cross hairs onto a particular geometric figure and maintaining the cross hairs on the figure for five seconds.

DISCUSSION: This item uses geometric figures rather than actual seeker video. The gunner is instructed to center the seeker cross hairs on the figure and hold them there for five (5) seconds. Each scenario has three (3) figures. The figures can be of any type (i.e. rectangle, triangle, square, circle, etc.). Each figure is to be available on the screen for ten (10) seconds. Each scenario increases in difficulty as follows:

a. Fixed size figures initially off center of screen. These three (3) figures each appear at ten (10) second intervals and at different positions on the screen.

b. Figures increasing in size, indicating seeker is approaching. These three (3) figures are initially off screen, appear at ten (10) second intervals, and at different positions.

c. Fixed size figures, initially off the screen, that move across the screen. These three (3) figures each appear at ten (10) second intervals, initially at different starting positions, and go in different directions.

d. Figures increasing in size, indicating seeker is approaching, and moving across the screen. These three (3) figures each appear at ten (10) second intervals, at different starting places, and go in different directions.

At the end of each scenario the gunner receives feedback in the form of a bar graph and accompanying text. The bar graph has each target labeled on the bottom axis and the total time each figure was on the screen, ten (10) seconds, on the vertical axis. The bar indicates the total actual time the seeker cross hairs were centered on the figure. The text feedback indicates the longest continuous period the cross hairs were on each target. At the end of scenario d., the gunner receives feedback and is asked to select further practice or continuing the lesson.

EQUIPMENT REQUIRED: Dynamic and static video presentations of geometric figures, seeker slew control.

PERFORMANCE MEASUREMENT

GUNNER REQUIRED ACTION: Center the seeker cross hairs and keep them in the center of the figures for five (5) seconds.

PERFORMANCE MEASUREMENT: The system measures how long the seeker cross hairs remain centered on the figure. Each figure is shown for ten (10) seconds. The acceptable position range for the center of the figure is an area of about 1/2 the figure size around its center. As long as the seeker cross hairs' center is in this area, the gunner is said to have centered the cross hairs. If the cross hairs stray off the center area, the are centered, even though they may be on a part of the figure. Time duration f centering is the performance measure.

PERFORMANCE MEASURES:

1. Ten (10) second time limit per figure.

2. Total seconds the gunner centers cross hairs.

3. Longest continuous period the cross hairs were centered on each target.

8. Simulated FOG-M cruise. Gunner is to use slew, zoom, and iris control to recognize objects of a given type (e.g., X's or tanks, depending upon available video), center them on the video display, and maintain the centered position for five seconds. Vary the following parameters:
a. Altitude.
b. Brightness.
c. Number of objects on the ground.
d. Location of objects.

There should be additional distractor figures in this scene, so the gunner must select the actual target and center it. Allow repeated practice until the gunner maintains the cross hairs on the object for the full time. This item is expanded on a Performance Measurement page at the end of Lesson 4.

The gunner is prompted to make the necessary adjustments (if any) to the video display, and to slew the seeker cross hairs to an object (designated by the system) and to maintain them centered on this object for five seconds. The gunner is given ten seconds to react to the system prompt. If the gunner fails to locate and place the seeker cross hairs on the designated object within the alloted time, the system recycles to the beginning of the scenario and instructs the gunner to retry. This procedure continues until the gunner can locate the object and maintain the cross hairs on it for the required time.

PERFORMANCE MEASUREMENT

LESSON: 4 USING THE SEEKER

TOPIC: Using the seeker

ITEM: 8

Simulated FOG-M cruise. Gunner is to use slew, zoom, and iris control to recognize objects of a given type (e.g., X's or tanks, depending upon available video), center them on the video display, and maintain the centered position for five seconds.

DISCUSSION: A simulated missile cruise with targets and additional distractor figures. Video begins with targets in view and the scene moves as a normal missile cruise of 60 seconds. The video scene has the following varying conditions:

a. Missile altitude
b. Scene brightness (introduce some shadows)
c. Number of targets or non-targets on the ground
d. Target locations

The gunner positions the seeker cross hairs on each target and keeps it centered for five (5) seconds. The time limit, five (5) seconds, for centering on a target is shown in the form of a countdown. If the cross hairs slip off the central mass of the target, the countdown restarts when the cross hairs are again centered on the target. When the countdown reaches zero (0) the system gives an audible beep and the gunner proceeds to another target. The countdown starts whenever the cross hairs are centered on a target's central mass. At the end of each 60 second simulated missile cruise the gunner is given feedback and selects practice with another scenario or continuation of the lesson. Feedback reports the number of targets centered, number of targets attempted, the total number of targets available in the simulation, and which targets were missed.

EQUIPMENT REQUIRED: Dynamic video with various targets and variable conditions, all seeker and missile controls.

GUNNER REQUIRED ACTION: Locate and center the seeker cross hairs on the targets. Keep the cross hairs centered on the target, continuously, for at least five (5) seconds.

PERFORMANCE MEASUREMENT: The system monitors the position of the seeker cross hairs. If the cross hairs are centered on a target's central mass, the five (5) second countdown is displayed. If the cross hairs slip off the target's central mass, the countdown is removed from the display and will start over when the cross hairs are centered on the target again. If the gunner keeps the cross hairs centered for the five (5) second

countdown, the system gives an audible beep when the countdown reaches zero (0). After the 60 second simulated missile cruise, the gunner is given feedback.

PERFORMANCE MEASURES:

1. Sixty (60) second simulated seeker video length.
2. Five (5) second centered time limit.
3. Number of targets centered within the time limit.
4. Number of targets attempted to center.
5. Total number of targets presented.

OBJECTIVES

Lesson Number: 5 Lesson Title: Navigating the FOG-M

Topic: A. Relating Map Display to Seeker Video

Topic training time: 30 min. Clas:U

Enabling Objective		Complete
07.	CONTROL [illegible] SCALE FLIGHT	
07.01	USE MAP DISPLAY AND RELATE TO VIDEO	X
07.01.01	SWITCH BETWEEN SEEKER VIDEO AND MAP DISPLAY	X
07.01.02	IDENTIFY CORRESPONDING LANDMARKS ON MAP DISPLAY AND SEEKER VIDEO	X

COURSEWARE OUTLINE

Lesson Number: 5 Lesson Title: Navigating the FOG-M

Topic: A. Relating Map Display to Seeker Video

Topic training time: 30 min. Clas:U

Content	Notes
1. Lesson introduction frame, estimated time, and narrative of topics to be covered. Lesson 5 teaches how to navigate from launch to target area using visual features and the map display. It also teaches basic control of altitude, azimuth, pitch, and roll. Topic 5A teaches how to use seeker visual cues and how to relate them to known features presented on the map display.	
2. Frame sequence and narrative explaining how to switch between regular video display and map display.	
3. Demonstration frame sequence and narrative for map reading:	
a. Picture of map as it will appear on video display.	Line drawing of map symbology.
b. Map symbology of critical terrain features, accompanied by still pictures of the actual terrain features taken from a FOG-M video display using the seeker video. Present several video views of the same symbology, both different actual features and the same feature from several distances and aspects.	Map alternates with video.
i. Roads	
ii. Railroads	
iii. Rivers	
iv. Representation of elevation	
v. Bodies of water	
vi. Buildings	
vii. Power lines	
viii. Pipelines	
iv. Marshland	
4. Practice using video to find specified objects or terrain features:	
a. A map is presented, with specific symbology and directions on what to look for.	

b. The gunner views a short flight segment and centers the seeker on the particular object or terrain feature. c. Gunner has both map and video available, and can switch between them using the standard procedure.	Moving video. Gunner puts the cross hairs on the particular terrain feature and pulls the joystick trigger. Allow gunner to repeat this item until he is has reached proficiency. If the gunner makes an incorrect selection, the system cues the gunner, records the error, and allows the gunner to continue. At the end of the map symbol selection practice, the gunner is scored. If the gunner's score is below 90 percent, the gunner is cued and retakes the unsatisfactory (error) portions of the practice. The gunner may choose to proceed without repeating any practice. (The same performance standards apply to the seeker video portion and the selection of actual terrain features.)

PERFORMANCE MEASUREMENT

LESSON: 5 Navigating the FOG-M

TOPIC: A. Relating Map Display to Seeker Video

ITEM: 4a.

Practice using video to find specified objects or terrain features:

a. A map is presented, with specific symbology and directions on what to look for.

DISCUSSION: In this item, the gunner is instructed to identify each of the following map symbols:

1. Railroad tracks
2. Power line
3. Pond
4. Trail junction
5. Crossroad
6. Bridge
7. River
8. Mountain
9. Pipeline
10. Small building

The gunner receives a prompt to mark a particular symbol. The symbol is marked by placing the display cross hairs on the symbol and pulling the trigger. Failure to mark the correct symbol causes the system to indicate a miss and to allow a second try. A second failure causes the correct symbol to flash. The gunner has five (5) seconds to mark each symbol. Failure to meet this time limit does not interrupt the lesson but is recorded as an error. Feedback includes: number of symbols marked correctly; number marked incorrectly; number of times over time limit; and number of symbols correctly marked the second time. The trainee elects more practice or continuation. Remedial items will present symbols in a different order using a different map.

EQUIPMENT REQUIRED: Map video with basic symbology, joystick trigger, and slew control.

GUNNER REQUIRED ACTION: Position the display cross hairs over the correct symbol and pull the trigger.

PERFORMANCE MEASUREMENT: If the cross hairs are over the correct symbol when the trigger is pulled, the correct symbol was marked. The symbol must be marked correctly within five (5) seconds. Identifying the incorrect

symbol causes on retrial. The system records the error and whether the mistake is corrected. A second failure causes the correct symbol to flash. Five (5) seconds are allowed per symbol and 150 seconds to complete the entire item. Recommend map symbology review if the 150 second limit is exceeded.

PERFORMANCE MEASURES:

1. Whether a symbol on a static map display is marked by a trigger depression (requires the symbol to be a defined area of the screen). Item 4b.

2. Time to respond to each prompt with a trigger depression.

3. Number of symbols marked correctly.

4. Number of symbols marked incorrectly.

5. Number of symbols not marked (due to overall time limit).

6. Number of mistakes corrected.

PERFORMANCE MEASUREMENT

LESSON: 5 Navigating the FOG-M

TOPIC: A. Relating Map Display to Seeker Video

ITEM: 4b.

b. The gunner views a short flight segment and centers the seeker on the particular object or terrain feature.

DISCUSSION: This item is similar to item 4a. The gunner identifies terrain items and vehicles using still video. The same ten (10) types of items may be used. Additionally, the video used in this item corresponds to the map in item 4a. The gunner has eight (8) seconds to identify each item and is prompted in the same way. Time for this item is 180 seconds.

EQUIPMENT REQUIRED: Moving video corresponding to the maps in item 4A, joystick trigger, and slew control.

GUNNER REQUIRED ACTION: Mark the items within the 8 second time limit per item by centering the seeker cross hairs on the item and pulling the trigger.

PERFORMANCE MEASUREMENT: Identify 10 types of seeker video display items. An incorrect item identification brings feedback. A second error causes the correct feature to be highlighted. Errors are recorded for feedback at the end of the item.

The gunner is not stopped for exceeding the time limit per item, but the error is recorded for feedback. If the time exceeds the 180 seconds, the items terminates. Feedback of errors occur at the end of the item. The gunner is asked to choose further practice or continuation.

PERFORMANCE MEASURES:

1. Whether an item on a static seeker video display is marked by a trigger depression (requires that target be a defined area of the screen).
2. Time to respond to each prompt with a trigger depression.
3. Number of correct items marked.
4. Number of incorrect items marked.
5. Number of items not marked (due to the overall time limit).
6. Number of mistakes corrected.

PERFORMANCE MEASUREMENT

LESSON: 5 Navigating the FOG-M

TOPIC: A. Relating Map Display to Seeker Video

ITEM: 4c.

c. Gunner has both map and video available, and can switch between them using the standard procedure.

DISCUSSION: First, the gunner is told to mark a symbol on the map, cycle to the dynamic missile video, and mark the feature on the video that corresponds with the marked map symbol. Each symbol/feature has 15 seconds to be identified.

Next, the gunner picks the feature on the video display, and then marks the corresponding symbol on the map display. When he marks a symbol or item that covers a large area, such as a river or lake, he must mark the corresponding symbol or item in a comparable position. For example, if he marks a river symbol, he must mark the position on the river that corresponds to the position on the map. Error feedback occurs at the end of 4c.

EQUIPMENT REQUIRED: Dynamic missile video with a corresponding map, ALT DISP switch, joystick trigger and slew control, and contrast/brightness controls.

GUNNER REQUIRED ACTION. Identify seeker video items and the corresponding map symbols. Identify map symbols and the corresponding seeker video items.

PERFORMANCE MEASUREMENT: Ability to pick a specific map symbol or seeker video item and to mark the corresponding seeker video item or map symbol. Marking the incorrect symbol or not marking the symbol in the corresponding place causes the system to record the error. A second error causes the corresponding symbol on the map to flash or, for the symbols covering larger areas, present a flashing circle.

Similarly, if an incorrect seeker item is marked, or placement is not correct, the system records the error. A second error causes the correct item to be highlighted at the corresponding place on the seeker video and the video is frozen. Failure to mark both symbol and seeker video within 15 seconds is an error. The entire item takes 180 seconds. Errors are reported and the gunner is prompted to return to items 4a and 4b for more practice, although he can choose to proceed.

PERFORMANCE MEASURES:

1. Whether the area marked first (video or map) is the same as that marked second. Video is static and map is static (requires that the target be defined area of the screen).

2. Time to identify and correlate map symbols and seeker video items.

3. Number of correctly marked symbols or items

4. Number of incorrectly marked symbols or items

5. Number of corrected mistakes.

OBJECTIVES

Lesson Number: 5 Lesson Title: Navigating the FOG-M

Topic: B. Controlling Flight During Cruise

Topic training time: 30 min. Clas:U

Enabling Objective		Complete
07.	CONTROL MISSILE FLIGHT	X
07.02.	ADJUST MISSILE PITCH, ROLL, AND ALTITUDE	X
07.02.01	ADJUST MISSILE PITCH	X
07.02.02	ADJUST MISSILE ROLL	X
07.02.03	ADJUST MISSILE ALTITUDE	X
07.03	MAKE ADJUSTMENTS TO MISSILE COURSE	X
07.03.01	ADJUST AZIMUTH	X
08.01	VERIFY INITIAL CRUISE PARAMETERS	
08.01.01	OBSERVE MISSILE PARAMETERS (PITCH, ROLL, ALTITUDE, AZIMUTH, FLIGHT PATH)	
08.01.01.01	MONITOR VIDEO DISPLAY TO CONFIRM THAT CORRECT INITIAL CRUISE ALTITUDE, ATTITUDE, AND COURSE HAVE BEEN ESTABLISHED	X
08.01.01.02	VERIFY CORRECT PITCH	X
08.01.01.03	VERIFY CORRECT ROLL	X
08.01.01.04	VERIFY CORRECT ALTITUDE	X
08.01.01.05	VERIFY CORRECT INITIAL AZIMUTH	X
08.02	RESTORE MISSILE TO COURSE FOLLOWING AN ERROR IN AUTOMATIC OR MANUAL NAVIGATION	
08.02.01	DETERMINE REQUIRED CONTROL INPUTS FOR COURSE CORRECTION	

COURSEWARE OUTLINE

Lesson Number: 5 Lesson Title: Navigating the FOG-M

Topic: B. Controlling Flight During Cruise

Topic training Time: 30 min. Clas:U

Content	Notes

1. Topic introduction frame, estimated time, and topics to be covered. Topic 5B teaches adjustment of azimuth, pitch, roll, and altitude to maintain steady cruise. Initial course verification is also covered.

2. Narrative about how the missile flies to the target. Include the concepts of:
a. Missile azimuth.
b. Missile pitch.
c. Missile roll.
d. Missile altitude.
e. How the above parameters affect the missile flight and the direction in which the seeker is pointing. Note that a change in azimuth is not the same as a complete course correction.

3. Frame sequence and narrative discussing how to verify initial course by using visual reference to landmarks, and by referring to the map display if necessary.

4. Frame sequence and narrative describing procedures for determining the values of, and adjusting:
a. Missile azimuth.
b. Missile pitch.
c. Missile roll.
d. Missile altitude.

5. Narrative of what actions to take in the event of the following missile control failures:
a. Missile pitch.
b. Missile roll.
c. Missile altitude.
d. Missile azimuth.

o. Narrative discussing a return to course. The following topics are covered:
a. Identifying current location.
b. Planning a course correction.
c. Intercepting the new course.
d. Aligning the missile on the new course.

7. Performance practice session. The missile is in cruise flight and the gunner is to make adjustments to return the missile to specified parameters. Parameters are:
a. Pitch.
b. Roll.
c. Altitude.
d. Azimuth.

Atmospheric conditions cause undesired changes in pitch, roll, altitude, azimuth. Performance measurement is discussed following this item.

Gunner is given specific missile flight parameters prior to the start of the practice. During the cruise, the system can induce changes in any of the flight parameters.

The gunner must detect any deviation in any of the flight parameters within five seconds of its occurrence. If the gunner fails to detect such a deviation, the system prompts the gunner and records the error. The gunner must adjust the deviated parameter to its original value within five seconds. If the gunner fails to restore the original value or errs in the adjustment, the system prompts the gunner and tells him to retry. If the gunner errs during the retry, the system prompts the

gunner, records the error, and continues the practice.

At the end of the practice, the gunner is scored. If the gunner's score is below 90 percent, the gunner is cued and retakes the unsatisfactory (error) portions of the practice. The gunner may proceed forward instead of retaking portions of the practice.

8. Performance practice session. The gunner flies the missile to a specified target area within +/- X km and finds ground targets specified on a video display. All flight parameters can be altered, within the framework of maximum flight time, and within the standard flight envelope of the missile. Missile crashes are indicated.	This is a full visual simulation. The gunner can fly within a reasonable distance of the proper flight path. Atmospheric conditions cause undesired changes in pitch, roll, altitude, azimuth. Repeat if performance is substandard. Performance measurement is discussed following this item. Gunner is given specific missile flight parameters prior to the start of the practice. During the cruise, the system can induce changes in any of the flight parameters. The gunner must detect any deviation in any of the flight parameters within five seconds of its occurrence. If the gunner fails to detect such a deviation, the system prompts the gunner and records the error. The gunner must adjust the deviated parameters to its original value within five seconds. If the gunner fails to restore the original value or errs in the adjustment, the system prompts the gunner and tells him to retry. If the gunner errs

during the retry, the system prompts the gunner, records the error, and continues the practice.

Gunner must reach the target area within the specified missile flight time. If the gunner reaches the target area, he must locate X number of targets within ten seconds (targets are specified by the system). If the gunner fails to locate the targets within the required time, the system prompts the gunner and tells him to retry. If the gunner fails on the retry, the system prompts the gunner and records the error.

At the end of the practice, the gunner is scored. If the gunner's scores is below 90 percent, the gunner is cued and retakes the unsatisfactory (error) portions of the practice. The gunner may proceed forward instead of retaking portions of the practice.

PERFORMANCE MEASUREMENT

LESSON: 5 Navigating the FOG-M

TOPIC: B. Controlling Flight During Cruise

ITEM: 7

Performance practice session. The missile is in cruise flight and the gunner is to make adjustments to return the missile to specified parameters.

DISCUSSION: Present user instructions and correct flight parameters. The gunner observes the missile starting on the correct azimuth, pitch, roll, and altitude. Then the missile slowly drifts off these parameters. When the drift is significant, five percent off the required parameter or greater, the system tells the gunner to correct the missile's path to the required parameters. For example, if the required azimuth is zero (0) degrees, when the missile's flight parameter reaches 12 degrees or 348 degrees the gunner is prompted to correct the flight path.

The required parameters are displayed on the screen throughout the entire cruise for the gunner's reference. The gunner has five (5) seconds to correct the missile path to satisfactorily complete this item; however, the maximum time allowed will be 30 seconds from the time he is given control of the missile. The parameters must be corrected to within the following tolerances:

a. Azimuth within + or - .5 degree.

b. Pitch within + or - 1 degree.

c. Roll within + or - X degrees.

d. Altitude within + or - 15 meters.

EQUIPMENT REQUIRED: Dynamic seeker video, all missile and seeker controls.

GUNNER REQUIRED ACTION: Correct flight parameters within the five (5) second time limit and be within the listed tolerances.

PERFORMANCE MEASUREMENT: The system monitors the time it takes to correct the missile's flight parameters. The gunner has no missile control until the prompt to correct the missile parameters is displayed. Feedback at the end of the item gives the parameters for the missile at the end of the five (5) second time limit, indicating the incorrect ones, and time to get the missile flight parameters within the tolerances.

PERFORMANCE MEASURES:

1. Five (5) second time limit to correct the missile flight parameters.

2. Missile parameters at the end of the five (5) second time limit.

3. Time to correct the flight parameters within the tolerances.

PERFORMANCE MEASUREMENT

LESSON: 5 Navigating the FOG-M

TOPIC: B. Controlling Flight During Cruise

ITEM: 8

Performance practice session. The gunner flies the missile to a specified target area within +/- km. and finds ground targets specified on a video display. All flight parameters can be altered, within the framework of maximum flight time, and within the standard flight envelope of the missile. Missile crashes are indicated.

DISCUSSION: Present instructions to navigate to a certain item on a map. The gunner has control of the missile and can switch between the map and seeker video. When the gunner has sight of the goal, he centers the seeker cross hairs on the item and pulls the joystick trigger. Feedback is immediate, correct or incorrect, and directs him to the correct item if necessary. There are ten (10) map symbols as goals:

1. Railroad tracks
2. Power line
3. Pond
4. Trail junction
5. Crossroad
6. Bridge
7. River
8. Mountain
9. Pipeline
10. Small building

Feedback at the end of the item contains the map symbols of the goals and whether they were reached successfully.

EQUIPMENT REQUIRED: Dynamic seeker video, static map video that corresponds to the seeker video, all missile and seeker controls.

GUNNER REQUIRED ACTION: Navigate missile to a symbol on the map and mark the corresponding item on the seeker video.

PERFORMANCE MEASUREMENT: Time to locate item. The time cannot exceed the maximum flight time of the missile. The map symbol stimulus is within the missile range. Verify if item is correct.

PERFORMANCE MEASUREMENT

PERFORMANCE MEASURES:

1. Time to navigate to and mark an item.
2. Whether the item marked is correct.
3. Whether the missile course was approximately correct.

COURSEWARE OUTLINE

Lesson Number: 5 Lesson Title: Navigating the FOG-M

Topic: C. Navigation Performance Test

Topic training time: 15 min. Clas:U

Content	Notes
1. Performance test. The gunner must maintain flight parameters during cruise. Gunner has five (5) seconds to restore parameter values. a. Azimuth +/- 0.5 degree. b. Pitch +/- 1 degree. c. Roll. d. Altitude.	Performance measurement is discussed following this item. Gunner is given specific flight parameter data for the missile flight. During the missile cruise, the missile course azimuth is indicated as being 270 degrees. Gunner's initial course azimuth was given as 245 degrees. Gunner must recognize the course deviation and make a correction to ± 0.5 degrees within five seconds. If the gunner fails to recognize the course deviation, the system (after five seconds) prompts the gunner regarding the course deviation and records the error. If the gunner recognizes the course deviation but errs in the course correction, the system prompts the gunner and tells him to retry. If the gunner errs on the retry, the system, records the error and continues the scenario.

During the cruise, pitch (up) is recognized to be three degrees. Missile pitch was initially specified as 0 degrees. Gunner must adjust missile to ± one degree of pitch within five seconds. If the gunner fails to make the required adjustment within the required time, the system prompts the gunner and tells him to retry. If the gunner errs in the pitch correction retry, the system records the error and continues the scenario.

Initial system information indicated the missile altitude should be XXX meters. Into the flight, the altitude exceeds XXX to YYY meters.

The gunner must recognize the unplanned increase in missile altitude and make adjustments to restore the XXX meter altitude within five seconds.

If the gunner fails to recognize the deviation in missile altitude, the system (after five seconds) prompts the gunner regarding the altitude deviation and records the error. If the gunner recognizes the altitude deviation but errs in the altitude

	adjustment, the system prompts the gunner and tells him retry. If the gunner errs on the retry, the system records the error and continues the scenario.
2. Performance test. A simulated cruise is presented, along with a map display. The gunner must switch between the seeker and map to find specified topographical features and landmarks, which are to be indicated with a button press. The missile responds to the alteration of all flight parameters, so that it can fly over the map terrain.	Performance measurement is discussed following this item. Gunner must identify a series of system specified terrain features/symbols on the seeker video and map display video. Gunner is given a map display and cues to locate specific terrain feature symbols within XX seconds. If the gunner fails to identify the symbology within the required time, the system prompts the gunner to retry. If the gunner fails during the retry, the system records the error and continues the test. The gunner is cued to change display to seeker video and to locate a series of terrain features specified by the system within XX seconds. If the gunner fails to identify the terrain features within the required time, the system prompts the gunner to retry. If the gunner fails during the retry, the

system records the error and continues the test.

At the end of the test, the gunner is scored. If the gunners's score is below 100 percent, the system prompts the gunner and tells him to retake the unsatisfactory (error) portions of the test.

3. Performance test. All flight parameters can be altered, within the framework of the maximum flight time, and within the standard flight envelope of the missile. Missile crashes are indicated. The gunner is to reach a specified target area within +/- X km. A map display is available.

The program should cause various flight parameters to change slowly during the mission. The gunner must monitor these values and the flight path and make the proper corrections. Performance measurement is discussed following this item.

Gunner is given specific flight parameter data for the missile flight. After the missile pitches over, the altitude is XXX meters. From the initial parameter data, the altitude should be YYY meter . The gunner must dete t the altitude deviati n within five seconds and make the altitude correction within another five seconds. If the gunner fails to recognize the altitude deviation within the required time, the system prompts the gunner and records the error. If the gunner errs in the altitude adjustment, the system prompts the gunner and tells him to retry.

If the gunner errs on the retry, the system prompts the gunner, records the error, and continues the test.

Initial missile azimuth was indicated to be XXX degrees, the system shows the azimuth to be YYY degrees. Gunner must recognize the azimuth deviation within five seconds and adjust the azimuth within another five seconds. If the gunner fails to recognize the azimuth deviation within the required time, the system prompts the gunner and records the error. If the gunner errs in the azimuth adjustment, the system prompts the gunner and tells him to retry. If the gunner errs on the retry, the system prompts the gunner, records the error, and continues the test.

Near the terminal point of the missile flight, the gunner slews the seeker to detect the target area. Gunner must locate the target area within five seconds. If the target area is visible, the gunner slews to put the seeker cross hairs on the target area. If the target area is not visible, the system prompts the gunner and records the error.

If the target area is not reached, the gunner is given a system prompt and is looped back to the

unsatisfactory (error) portion of the test. The gunner may proceed forward instead of retaking portions of the test.

PERFORMANCE MEASUREMENT

LESSON: 5 Navigating the FOG-M

TOPIC: C. Navigation Performance Test

ITEM: 1

Performance tests. The gunner must maintain flight parameters during cruise. Gunner has five (5) seconds to restore parameter values.

DISCUSSION: Present user instructions for the performance test. This item is the first part of the test. Give correct flight parameters for a missile flight. The gunner observes the missile starting on the correct azimuth, pitch, roll, and altitude. Then the missile slowly drifts off these parameters. When the drift is significant, five percent off the required parameter or greater, the system tells the gunner to correct the missile's path to the required parameters. For example, if the required azimuth is zero (0) degrees, when the missile's flight parameter reaches 12 degrees or 348 degrees the gunner is prompted to correct the flight path.

The required parameters are displayed on the screen throughout the entire cruise. The gunner has five (5) seconds to correct the missile path to satisfactorily complete this item test; the time of flight is 30 seconds. The parameters must be corrected to within the following tolerances:

a. Azimuth within + or - .5 degree.

b. Pitch within + or - 1 degree.

c. Roll within + or - X degrees.

d. Altitude within + or - 15 meters.

EQUIPMENT REQUIRED: Dynamic seeker video, all missile controls.

GUNNER REQUIRED ACTION: Correct flight parameters within the five (5) second time limit.

PERFORMANCE MEASUREMENT: The system monitors the time it takes the gunner to correct the missile's flight parameters from the time he is told to make the corrections to the time the flight parameters are within the listed tolerances. Feedback at the end of the item gives parameters for the missile with an indication of the incorrect ones, and the time to get missile flight parameters within tolerances.

PERFORMANCE MEASURES:

1. Five (5) second time limit to correct the missile flight parameters.

2. Missile parameters at the end of the five (5) second time limit.

3. Time to correct the flight parameters within the tolerances listed above.

PERFORMANCE MEASUREMENT

LESSON: 5 Navigating the FOG-M

TOPIC: C. Navigation Performance Test

ITEM: 2

Performance test. A simulated cruise is presented, along with a map display. The gunner must switch between the seeker and map to find specified topographical features and landmarks, which are to be indicated with a button press. The missile responds to the alteration of all flight parameters, so that it can fly over the map terrain.

DISCUSSION: This is the second part of the item performance test. In this part the gunner is given a set of instructions to navigate a missile to a certain feature on a map. The gunner has control of the missile and can switch between the map and seeker video. The gunner centers the seeker cross hairs on the feature and pulls the joystick trigger. Feedback is immediate. Feedback indicates correct or incorrect and provides correct item if selection was incorrect. There are ten (10) map symbols:

1. Railroad tracks
2. Power line
3. Pond
4. Trail junction
5. Crossroad
6. Bridge
7. River
8. Mountain
9. Pipeline
10. Small building

Overall feedback is given after the 10 items. Feedback contains the map symbols marked correctly, the map symbols marked incorrectly, and map symbols not found.

EQUIPMENT REQUIRED: Dynamic seeker video, static map video that corresponds to the seeker video, all missile and seeker controls.

GUNNER REQUIRED ACTION: Navigate missile to a symbol on the map and mark the corresponding item on the seeker video.

PERFORMANCE MEASUREMENT: Monitor time to locate each item. Time cannot exceed the maximum flight time of the missile. The map symbol goal is within missile range. The system also determines if the correct item is marked.

PERFORMANCE MEASURES:

1. Time to navigate to and mark an item.

2. Whether the item marked is correct.

3. Whether the missile was navigated toward the map symbol in cases where the actual mark was incorrect.

PERFORMANCE MEASUREMENT

LESSON: 5 Navigating the FOG-M

TOPIC: C. Navigation Performance Test

ITEM: 3

All flight parameters can be altered, within the framework of the maximum flight time, and within the standard flight envelope of the missile. Missile crashes are indicated. The gunner is to reach a specified target area within +/- X km. A map display is available.

DISCUSSION: This is the last part of the performance test in lesson 5. The gunner flies a missile to a target area on the displayed map. If the missile crashes the system gives three audible beeps and a message is displayed on the screen explaining what happened. If the missile crashes or runs out of time, the item is unsatisfactorily completed and an explanation is given as to what went wrong.

EQUIPMENT REQUIRED: Dynamic seeker video with a corresponding map, all missile and seeker controls.

GUNNER REQUIRED ACTION: Navigate to a target area without crashing the missile or exceeding the maximum missile flight time.

PERFORMANCE MEASUREMENT: Does missile reach the target area without crashing? A crash causes the system to give three audible beeps, seeker video to go off, and a message explaining the reason for the item interruption is displayed. If maximum flight time is exceeded before reaching the target area, the system gives two audible beeps, turns the seeker video off, and displays a message explaining the item interruption.

PERFORMANCE MEASURES:

1. Whether the missile reaches the target area before the flight time expires.

2. Whether the missile altitude is more than the ground altitude for the entire flight.

OBJECTIVES

Lesson Number: 5 Lesson Title: Navigating the FOG-M

Topic: D. Adjustment During Cruise

Topic training time: 30 min. Clas:U

Enabling Objective		Complete
08.	NAVIGATE MISSILE	
08.01	VERIFY INITIAL CRUISE PARAMETERS	X
08.01.01	OBSERVE MISSILE PARAMETERS (PITCH, ROLL, ALTITUDE, AZIMUTH, FLIGHT PATH)	X
08.01.01.06	VERIFY HEADING CHANGES BY OBSERVING KEY LANDMARKS & SWITCHING TO MAP DISPLAY, ADJUST IF NECESSARY	X
08.02	RESTORE MISSILE TO COURSE FOLLOWING AN ERROR IN AUTOMATIC OR MANUAL NAVIGATION	X
08.02.01	DETERMINE REQUIRED CONTROL INPUTS FOR COURSE CORRECTION	X
08.04	NAVIGATE WITH CORRELATOR	X
08.04.01	VERIFY THAT CORRELATOR IS WORKING PROPERLY DURING AUTOMATIC CRUISE	X
08.04.02	RECOGNIZE THAT CORRELATION HAS FAILED AND CAUSE OF FAILURE	X
08.04.02.01	STATE DISTINCTION BETWEEN CORRELATOR FAILURE AND FAILURE TO ACHIEVE SATISFACTORY INDEX OF CORRELATION.	X
08.04.03	ADJUST PATH OF PROBLEM MISSILE TO REINSTATE CORRELATION WHEN PROBLEM IS LOW INDEX OF CORRELATION	X
08.04.04	NAVIGATE MISSILE MANUALLY WHEN CORRELATOR FAILS	X
08.05	MONITOR VIDEO DISPLAY TO CONFIRM THAT PROGRAMMED HEADING CHANGES ARE MADE (AT WAYPOINTS)	X
08.05.01	RETURN TO CORRECT COURSE FOLLOWING WAYPOINT CHECK ERROR	X

COURSEWARE OUTLINE

Lesson Number: 5 Lesson Title: Navigating the FOG-M

Topic: D. Adjustment During Cruise

Topic training time: 30 min. Clas:U

Content	Notes
1. Topic introduction frame, estimated time, and topics to be covered. Topic 5D teaches how to use azimuth, pitch, roll, and altitude to change course. Verification of the correlator is also covered. Problems with flight are covered.	
2. Narrative discussing automatic navigation. Discuss the following: a. How the system follows a course using altitude and attitude preprogrammed inputs. b. How the correlator can be used to verify that the missile is flying over a route that has been flown previously. c. How the gunner can visually verify that the missile is flying the expected route. Verify: i. Landmarks along the route. ii. Course changes at waypoints.	
3. Frame sequence and narrative discussing how to take the missile out of automatic mode to input course corrections.	
4. Frame sequence and narrative discussing how to verify that the correlator is working properly: a. How to tell if correlator has failed or if the index of correlation has become too low for navigation. b. Steps to take in each case.	
5. Performance practice mission scenarios where missile flies on an automatic course. The gunner diagnoses problems and returns the missile to the proper course. The missile must reach the target area within +/- X km. within the maximum flight time. The following problems are among those that will be covered: a. Fly around a mountain that is too high to fly over.	After completing all scenarios, repeat those on which the gunner is substandard. Performance measurement is discussed following this item. Feed back time and errors.

b. Use correlator on specified scenarios and have correlator fail on one scenario.
c. Fly over both mountainous and flat terrain.
d. Fly over built-up areas.
e. Fly over a large lake.
f. Fly over a solidly forested or jungle area.
g. Fly over snow covered terrain.
h. Fly over a desert.
i. Fly during extreme atmospheric conditions (e.g., wind, heat, rain, snow) that affect roll, pitch, and altitude during flight.

Gunner is given specific missile flight parameters prior to the start of the practice. During the cruise, the system can induce changes in any of the flight parameters.

The gunner must detect any deviation in any of the flight parameters within five seconds of its occurrence. If the gunner fails to detect such a deviation, the system prompts the gunner and records the error. The gunner must adjust the deviated parameter to its original value within five seconds. If the gunner fails to restore the original value or errs in the adjustment, the system prompts the gunner and tells him to retry. If the gunner errs during the retry, the system prompts the gunner, records the error, and continues the practice.

Gunner must reach the target area within the specified missile flight time. If the gunner fails to reach the target area, the system prompts the gunner and records the error. If the gunner reaches the target area, he must locate X number of targets within ten seconds

(targets are specified by the system). If the gunner fails to locate the targets within the required time, the system prompts the gunner and tells him to retry. If the gunner fails on the retry, the system prompts the gunner and records the error.

At the end of the practice, the gunner is scored. If the gunner's score is below 90 percent, the gunner is cued and retakes the unsatisfactory (error) portions of the practice. The gunner may proceed forward instead of retaking portions of the practice.

PERFORMANCE MEASUREMENT

LESSON: 5 Navigating the FOG-M

TOPIC: D. Adjustment During Cruise

ITEM: 4

Performance practice mission scenarios where missile flies on an automatic course. The gunner diagnoses problems and returns the missile to the proper course. The missile must reach the target area within +/- km. within the maximum flight time.

DISCUSSION: This item presents a series of practice missions that simulate several navigational problems the gunner may encounter. There are eight (8) scenarios:

a. A missile flight to a target area that requires the missile to be flown around a mountain that is too high to fly over.

b. A missile flight to a target area using the correlator. The correlator fails prior to reaching the target area.

c. A missile flight to a target area that requires flying over both mountainous and flat terrain.

d. A missile flight over a built-up area.

e. A missile flight over a large lake.

f. A missile flight over a solidly forested or jungle area.

g. A missile flight over terrain covered by snow.

h. A missile flight over a desert.

Each of these scenarios uses seeker video and a corresponding map. The gunner starts at the beginning of the missile cruise and continues, with full missile control, to navigate the missile to the target area. If the missile crashes, the video goes blank, the system gives three (3) audible beeps, and the screen displays a message explaining the error. Flight time limits hold. At the end of the scenario the actual flight path, optimum flight path, crash site, and time are displayed. Paths and crash sites are shown on the map display. Scenarios are to be presented in random order. At the end of the eighth scenario the gunner selects more practice or lesson continuation.

EQUIPMENT REQUIRED: Dynamic missile video, all missile and seeker controls.

PERFORMANCE MEASUREMENT

GUNNER REQUIRED ACTION: Navigate to the designated target area within allowed time and without crashing.

PERFORMANCE MEASUREMENT: The system continually monitors the missile altitude to see if the missile crashes. Also, the system checks to see that the missile enters the target area before flight time expires. The target area is chosen by the system and is given to the gunner in the scenario description. Feedback occurs at the end of each scenario showing flight path, any crash sites, optimum flight path, flight time, and optimum flight time.

PERFORMANCE MEASURES:

1. Time to fly to target area.
2. Missile altitude and ground altitude.

OBJECTIVES

Lesson Number: 6 Lesson Title: Target Detection, Recognition, and Identification.

Topic: A. Detect Target

Topic training time: 30 min. Clas:U

Enabling Objective		Complete
09.	DETECT, RECOGNIZE, IDENTIFY TARGETS	
09.01	DETECT TARGET(S)	X
09.01.01	DISCRIMINATE TARGET AREA FROM BACKGROUND VIDEO	X
09.01.01.01	KNOW VISUAL CUES THAT SUGGEST THAT A VISUAL PATTERN IS A TARGET	X
10.01.01	CHANGE TRACKER CONTRAST DIRECTION IF SELECTED TARGET IS BRIGHTER THAN BACKGROUND	X

COURSEWARE OUTLINE

Lesson Number: 6 Lesson Title: Target Detection, Recognition, and Identification

Topic: A. Detect Target

Topic training time: 30 min. Class:U

Content	Notes
1. Lesson introduction frame and narrative of topics to be covered. Purpose of Lesson 6 is to provide experience for the trainee to detect the presence of possible targets, recognize whether friend of foe, and identify the value of the target so as to select the proper one for lock-on. Topic A will teach detection of easily detected targets.	
2. Frame sequence and narrative discussing target area discrimination from other background video in order to detect a target. Discuss changing contrast direction to maximize detectability of target. Present the following still targets to illustrate: a. Armored vehicles in an open area. b. Armored vehicles in a built-up area. c. Armored vehicles in a lightly wooded area. d. Armored vehicles in a densely wooded area. e. Armored vehicles interspersed among rocks. f. Rock formations and shadow effects that could be mistaken for armored vehicles.	Use still frames from videodisc. Use pictures of actual targets in the specified environment. Allow the gunner to review the frames as desired.
3. Frame sequence and narrative discussing visual cues and patterns suggesting the presence of a target, leading to detection. Topics to discuss: a. Trail of obvious tank tracks. b. Track trail dis ppearing into broken vegetation. c. Profile of tank turret and primary gun tube in shadowed area. d. Engine exhaust plume. e. Tank tracks leading to a ground excavation (revetment). f. Overhead view of a tank in a shadowed area.	Same as 2.

4.	Sequence of targets listed in Item 3, a-f.	Allow ten (10) seconds per target. Give clues if gunner fails to note target during this period. Clues can suggest where target is. Selection must be made within ten (10) seconds. If the selection is not made within the required time, the system prompts the gunner to retry or continue to the next scenario. If the gunner makes an incorrect selection, the system gives the gunner a clue to the actual target and prompts him to retry. If the second selection is incorrect, the system records the error and cycles to the next scenario. At the end of the test, the gunner is scored. If the gunner's score is below 90 percent, the gunner is cued and retakes the unsatisfactory (error) portions of the test. The gunner has the choice of preceeding forward without retaking any portions of the test.

OBJECTIVES

Lesson Number: 6 Lesson Title: Target Detection, Recognition, and Identification

Topic: B. Detect Target Under Camouflage/Obscuration

Topic training time: 30 min. Clas:U

Enabling Objective		Complete
09.	DETECT, RECOGNIZE, IDENTIFY TARGETS	
09.01.02	DETECT TARGETS THAT ARE CAMOUFLAGED	X
09.01.03	DETECT TARGETS IN VISUAL OBSCURATION (SMOKE, VEGETATION, and FOG)	X

COURSEWARE OUTLINE

Lesson Number: 6 Lesson Title: Target Detection, Recognition, and Identification

Topic: B. Detect Target Under Camouflage/Obscuration

Topic training time: 30 min. Clas:U

Content	Graphic
1. Introductory frame. Topic 6B teaches detection under camouflage and obscured visual conditions.	
2. Frame sequence and narrative discussing various materials that might conceal the target: a. Camouflage materials: i. Natural site materials. ii. Artificial material (netting). iii. Combination of natural and artificial materials. b. Forms of existing visual obscuration: i. Smoke and dust. ii. Fog. iii. Vegetation.	Use pictures on videodisc. Use actual scenes if possible.
3. Frame sequence and narrative presents an armored vehicle camouflaged with natural site materials. Present the following views of armored vehicles (primary FOG-M targets): a. Overhead view. b. Silhouette view of right and left sides. c. Frontal view. d. Rear view. e. Quartering views: i. Right front. ii. Left front. iii. Right rear. iv. Left rear.	Same as 1.
4. Frame sequence and narrative presenting an armored vehicle camouflaged with artificial materials (netting): a. Overhead view. b. Silhouette view of right and left sides. c. Frontal view. d. Rear view.	Same as 1.

e. Quartering views:
   i. Right front.
   ii. Left front.
   iii. Right rear.
   iv. Left rear.

5. Frame sequence and narrative presenting an armored vehicle camouflaged with a combination of natural and artificial materials: Same as 1.
a. Overhead view.
b. Silhouette view of right and left sides.
c. Frontal view.
d. Rear view.
e. Quartering views:
   i. Right front.
   ii. Left front.
   iii. Right rear.
   iv. Left rear.

6. Frame sequence and narrative presenting an armored vehicle obscured by smoke and/or dust: Same as 1.
a. Overhead view.
b. Silhouette view of right and left sides.
c. Frontal view.
d. Rear view.
e. Quartering views:
   i. Right front.
   ii. Left front.
   iii. Right rear.
   iv. Left rear.

7. Frame sequence and narrative presenting an armored vehicle obscured by fog: Same as 1.
a. Overhead view.
b. Silhouette view of right and left sides.
c Frontal view.
d. Rear view.
e. Quartering views:
   i. Right front.
   ii. Left front.
   iii. Right rear.
   iv. Left rear.

8. Frame sequence and narrative presenting an armored vehicle obscured by vegetation: Same as 1.
a. Overhead view.
b. Silhouette view of right and left sides.
c. Frontal view.
d. Rear view.

e. Quartering views:
   i. Right front.
   ii. Left front.
   iii. Right rear.
   iv. Left rear.

COURSEWARE OUTLINE

Lesson Number: 6 Lesson Title: Target Detection, Recognition, and Identification

Topic: C. Target Detection Performance Test

Topic training time: 30 min. Clas:U

Content	Graphic
1. Introductory frame, time estimate, and topics to be covered. Topic 6C assesses how well the trainee has learned target detection and the cues suggesting the presence of a target.	
2. Scenarios of missile flight to a point where a target area can first be detected. The gunner is to move the seeker so the cross hairs are in a target area, and then pull the trigger. The video freezes 30 seconds after the target area has been detectable by an experienced FOG-M gunner. The purpose is to have the gunner learn what cues he must use for early detection of a target. The trainee has 30 seconds longer than an experienced gunner would require. At the end of each scenario the actual targets are highlighted.	Present scenes as they would appear if the missile were approaching them.
a. Armored vehicles deployed in the open.	Some of these items can be presented in the same scenario (e.g., tank tracks and vegetation). Recommend that gunner review the training for specific items that he does not recognize at all. Present a second trial with new material if he simply does not meet time constraints. Performance measurement discussed follow-this item. Gunner must detect and recognize a target within 10 seconds from the time it first comes into seeker range. If the gunner fails to recognize the target in the required time,
b. Armored vehicles deployed in a built-up area.	
c. Armored vehicles deployed in a lightly wooded area.	
d. Armored vehicles deployed in dense woods.	
e. Armored vehicles deployed in rocky terrain.	
f. Trail of armored vehicle tracks.	
g. Track trail disappearing into broken vegetation.	
h. Various views of an armored vehicle in a shadowed area.	
i. Armored vehicles engine exhaust plumes.	
j. Armored vehicles in excavated revetments.	
k. Armored vehicles camouflaged with natural materials.	
l. Armored vehicles camouflaged with artificial materials.	
m. Armored vehicles camouflaged with a combination of natural and artificial materials.	
n. Armored vehicles moving and stationary in smoke and/or dust.	

o. Armored vehicles moving and stationary in ground fog.
p. Armored vehicles moving and stationary in vegetation.

the gunner is prompted and told to retry. If the gunner fails on the retry, the system freezes the video, highlights the cues indicating a target area, and records the error.

When the target has been detected, the gunner must mark a series of visual cues and targets within 10 seconds. If the gunner fails to recognize the cues and targets within the required time or errs in the detection marking, the system prompts the gunner and tells him to retry. If the gunner errs during the retry, the system records the error and highlights the missed visual cues and targets.

At the end of the test, the gunner is scored. If the gunner's score is below 90 percent, the gunner retakes the unsatisfactory (error) portions of the test (new scenarios). The gunner may choose to proceed forward rather than retake portions of the test.

PERFORMANCE MEASUREMENT

LESSON: 6 Target Detection, Recognition, and Identification

TOPIC: C. Target Detection Performance Test

ITEM: 2

Scenarios of missile flight to a point where a target area can first be detected. The gunner is to move the seeker so the cross hairs are in a target area, and then pull the trigger. The video freezes 30 seconds after the target area has been detectable by an experienced FOG-M gunner. The purpose is to have the gunner learn what cues he must use for early detection of a target. The trainee has 30 seconds longer than an experienced gunner would require. At the end of each scenario the actual targets are highlighted.

DISCUSSION: This item teaches the visual cues leading to early target detection. A still picture of a target area appears, using photographic imagery. The gunner has 15 seconds to mark all cues suggesting targets. As feedback, all cues are highlighted, with the gunner's marks remaining for comparative purposes. No performance measures are recorded for this demonstration item.

The first video has the following visual cues present, as a minimum: tanks deployed in open area, trail of tank tracks, tank engine exhaust plumes. The second video has the following visual cues present, as a minimum: tanks deployed in rocky terrain; tanks deployed in a built-up area; various views of tanks in shadowed area; tanks camouflaged with natural materials only, artificial materials only, and both natural and artificial materials. The third video has the following visual cues: tanks deployed in lightly and densely wooded areas; trail of tank tracks; trail of tank tracks disappearing into broken vegetation; various views of tanks in shadowed areas; tank engine exhaust plumes; tanks moving and stationary in vegetation; tanks with varying types of camouflage. The fourth video has the following visual cues, as a minimum: tanks deployed in open area; trail of tank tracks; tank engine exhaust plumes; tanks in excavated revetments; tanks in smoke and/or dust. The fifth video has the following visual cues, as a minimum: tanks deployed in open area with varying degrees of vegetation; tanks moving and stationary in ground fog; tank engine exhaust plumes.

EQUIPMENT REQUIRED: Dynamic video with tanks and trucks in various types of terrain and environments; seeker SLEW, ZOOM, and IRIS controls; video BRIGHTNESS/CONTRAST controls; JOYSTICK trigger.

PERFORMANCE MEASUREMENT

GUNNER REQUIRED ACTION: Locate and mark all visual cues of targets when the video freezes. This action is prompted by the system. After 15 seconds the system highlights any cues missed.

PERFORMANCE MEASUREMENT: The system must keep track of the cues marked in the 15 second time frame. The system will highlight the cues missed and ask the gunner if he desires to return to the specific item from the previous two topics that teach the material that he did not pass.

PERFORMANCE MEASURES:

1. Fifteen (15) second time limit per item.

2. Whether or not the predetermined target areas are marked.

OBJECTIVES

Lesson Number: 6 Lesson Title: Target Detection, Recognition, and Identification

Topic: D. Recognize/Identify Targets

Topic training time: 15 min. Clas:U

Enabling Objective		Complete
09.	DETECT,RECOGNIZE,IDENTIFY TARGETS	X
09.02	RECOGNIZE,IDENTIFY TARGET(S)	X
09.02.01	ZOOM IN ON TARGETS	X
09.02.02	DISCRIMINATE BETWEEN BRIEFED TARGETS AND OTHER TARGETS THAT MAY BE PRESENT	X
09.02.03	DIFFERENTIATE BETWEEN HIGH-PRIORITY AND LOW-PRIORITY ENEMY TARGETS	X
09.02.04	DIFFERENTIATE BETWEEN TARGETS AND FRIENDLIES	X

COURSEWARE OUTLINE

Lesson Number: 6 Lesson Title: Target Detection, Recognition, and Identification

Topic: D. Recognize/Identify Targets

Topic training time: 15 min. Clas:U

Content	Notes
1. Introductory frame, time estimates, and topics to be covered. Topic 6D teaches recognition and identification of targets so that the student can pick out the highest value enemy target.	
2. Frame sequence and narrative presenting key features that aid in differentiating friendly from enemy tanks. a. Overhead view of friendly and enemy tanks. b. Silhouette view of right and left sides of friendly and enemy tanks. c. Frontal view of friendly and enemy tanks. d. Rear view of friendly and enemy tanks. e. Quartering views of friendly and enemy tanks: i. Right front. ii. Left front. iii. Right rear. iv. Left rear.	Use actual photos of target material. Still views.
3. Frame sequence and narrative discussing the identification of the best target from among the possible targets detected and recognized	
4. Frame sequence and narrative presenting methods to differentiate between high-priority and low-priority enemy targets. Discuss the priority of the following: a. Enemy tank classifications. b. Enemy mobile rocket launchers. c. Enemy artillery.	
5. Present a series of still scenes in which the gunner is to identify and select a known (briefed) target from other objects. a. Select the briefed target that is among bunkers, brush and small buildings. b. Select the briefed target from among various other types of combat vehicles.	Same as 2. If performance is substandard, repeat item 2 and then this item. Selection of the correct target must

i. Wheeled combat vehicles
ii. Tracked combat vehicles

c. Select the briefed target from other armored combat vehicles in the target area.

be made within 10 seconds of scene appearing on the video display. If the gunner fails to select the correct target within the allotted time, or selects an incorrect target, the system prompts him to retry. If the gunner succeeds on the retry, the system cycles to the next scenes. However, if he fails again the error is recorded and the system cycles to the next scene. This procedure continues throughout the practice. The gunner must achieve 100 percent proficiency in differentiating friendly from enemy targets or else he is prompted and retakes the unsatisfactory (error) portion of the practice until proficiency is reached. The gunner must achieve an 80 percent level of proficiency on all other aspects of target selection. If his proficiency level is below 80 percent, the gunner retakes the unsatisfactory (error) portions of the practice. The gunner may choose to proceed forward rather than retake part of the practice.

6. Present a series of scenarios in which the gunner is to identify/select the appropriate (briefed) target from among other targets. a. Tanks among wheeled or tracked vehicles. b. Tanks among armored personnel carriers. c. Mobile missile systems among artillery. d. Tanks among fortified field positions. e. Tanks among mobile missile systems and artillery. f. Tanks among fixed missile sites. g. Tanks among anti-tank weapon systems.	Same as 2. If performance is substandard, repeat item 2 and then this item.
7. Present a series of performance practice scenarios in which the gunner is to select enemy targets from similar friendlies. a. Enemy and friendly tanks. b. Enemy and friendly wheeled or tracked vehicles. c. Enemy and friendly artillery. d. Enemy and friendly anti-tank weapon systems.	Same as 2. If performance is substandard, repeat this item.

PERFORMANCE MEASUREMENT

LESSON: 6 Target Detection, Recognition, and Identification

TOPIC: D. Recognize and Identify Targets

ITEM: 6

Present a series of scenarios in which the gunner is to identify/select the appropriate (briefed) target from among other targets.

DISCUSSION: This item gives practice in identifying targets and distinguishing briefed targets from other enemy units. A briefing describes the target area, target of interest, and other enemy units believed to be in the target area. The system presents simulated missile video starting at a point just before entering the target area. The gunner has control of the missile and seeker video. He locates and marks the target of interest by placing the seeker cross hairs on the target's main body and pulling the JOYSTICK trigger.

Each scenario presents one of the following situations:

a. Tanks among wheeled or tracked vehicles.
b. Tanks among armored personnel carriers.
c. Mobile missile systems among artillery.
d. Tanks among fortified field positions.
e. Tanks among mobile missile systems and artillery.
f. Tanks among fixed missile sites.
g. Tanks among antitank weapon systems

Each of these scenarios has a specific target type as the target of interest appropriate for the tactical situation.

EQUIPMENT REQUIRED: Dynamic missile video, all missile and seeker video controls, JOYSTICK trigger.

GUNNER REQUIRED ACTION: Read mission briefing and indicate when ready to continue. Mark correct target.

PERFORMANCE MEASUREMENT: Measure position of the center of the seeker cross hairs when the JOYSTICK trigger is pulled. Only the target of interest is accepted as correct. The mark must be on the main body of the target. The system keeps track of incorrectly marked targets as well as correctly marked targets and present this information at the end of each scenario. Each scenario is 60 seconds long. Failures may be reattempted at the trainee's discretion.

PERFORMANCE MEASURES:

1. Sixty (60) second simulated seeker video length.
2. Correctly marked targets.
3. Number of incorrect targets marked.
4. Number of correct targets marked.

PERFORMANCE MEASUREMENT

LESSON: 6 Target Detection, Recognition, and Identification

TOPIC: D. Recognize/Identify Targets

ITEM: 7

Present a series of performance practice scenarios in which the gunner is to select enemy targets from similiar friendlies.

DISCUSSION: This item gives practice in identifying targets and distinguishing briefed targets from other enemy units. A briefing describes the target area, target of interest, and other enemy units believed to be in the target area. The system presents simulated missile video starting at a point just before entering the target area. The gunner has control of the missile and seeker video. He locates and marks the target of interest by placing the seeker cross hairs on the target's main body and pulling the JOYSTICK trigger.

Each scenario presents one of the following situations:

a. Enemy and friendly tanks
b. Enemy and friendly wheeled or tracked vehicles
c. Enemy and friendly artillery
d. Enemy and friendly antitank weapon systems

Each of these scenario presentations has a specific target type as the target of interest appropriate for the tactical situation.

EQUIPMENT REQUIRED: Dynamic missile video, all missile and seeker video controls, JOYSTICK trigger.

GUNNER REQUIRED ACTION: Read mission briefing and indicate when ready to continue. Mark correct target.

PERFORMANCE MEASUREMENT: Measure position of the center of the seeker cross hairs when the JOYSTICK trigger is pulled. Only the target of interest is accepted as correct. The mark must be on the main body of the target. The system keeps track of incorrectly marked targets as well as correctly marked targets and presents this information at the end of each scenario. Each scenario is 60 seconds long. Failures may be reattempted at the trainee's discretion.

PERFORMANCE MEASURES:

1. Sixty (60) second simulated seeker video length.
2. Whether the gunner marks a target correctly.
3. Number of incorrect targets marked.
4. Number of correct targets marked.
5. Number of friendlies marked as enemy targets.

COURSEWARE OUTLINE

Lesson Number: 6 Lesson Title: Target Detection, Recognition, and Identification

Topic: E. Target Recognition and Identification Performance Test

Topic training time: 15 min. Clas:U

Content	Notes
1. Present a series of 10 scenarios using the variables discussed in the previous topic on target selection. The gunner must find and mark 9 out of 10 appropriate targets, and must not mark any friendlies for FOG-M strike.	Use actual target photos. Performance measurement discussed following this item. Selection of the target in each of the scenarios must be made within 15 seconds. If selection is not made in the required time, the system prompts the gunner to retry or continue to the next scenario. If the gunner makes an incorrect selection, the system cues the gunner this his selection was incorrect and to retry. If the second selection is incorrect, the system records the error and cycles to the next scenario. At the end of the test, the gunner is scored. If the gunner's score is below 80 percent, the gunner is cued and retakes the unsatisfactory (error) portions of the test. The gunner may proceed forward instead of retaking portions of the test.

PERFORMANCE MEASUREMENT

LESSON: 6 Target Detection, Recognition, and Identification

TOPIC: E. Target Recognition and Identification Performance Test

ITEM: 1

Present a series of 10 scenarios using the variables discussed in the previous topic on target selection. The gunner must find and mark 9 out of 10 appropriate targets, and must not mark any friendlies for FOG-M strike.

DISCUSSION: Present a target area containing ten (10) stationary and/or moving enemy armored vehicles and various friendly distractor vehicles. The position and aspect of the tanks and vehicles vary. The gunner is instructed to use any seeker video display controls necessary to locate, select, and mark enemy targets. The gunner must mark nine (9) out of ten (10) enemy targets and not mark any friendly vehicles within a 60 second time limit per scenario. The final measure is the number of enemy targets marked during the scenario.

In order for the gunner to mark an enemy target, he must slew the seeker cross hairs to the selected target and pull the JOYSTICK trigger. A correct mark is achieved if the cross hairs are centered on the main mass of the target, that is, the body of the target and not the gun barrel protruding from the turret of the enemy tank. Successful completion of this item, locking onto nine (9) out of ten (10) targets within the time limit, will cause the system to ask the gunner if he wants to practice with another scenario or continue to the next item.

EQUIPMENT REQUIRED: For this item the gunner will need the following: Dynamic video with ten (10) enemy targets and various friendly vehicles, all seeker and missile controls.

GUNNER REQUIRED ACTION: Correctly mark the enemy targets.

PERFORMANCE MEASUREMENT: The gunner is measured during each scenario by his ability to mark nine (9) out of ten (10) enemy targets. Any errors are recorded for feedback at the end of each scenario. The feedback will give him the number of correct targets he marked and the number of enemy targets he missed as well as any friendly targets he may have marked. The specific targets not correctly marked will also be included in the feedback. The gunner is then asked if he desires to practice another scenario or if he wants to continue.

PERFORMANCE MEASURES:

1. Whether the gunner has marked a target within a specified area of the target during the dynamic video presentation.

2. Number of correctly marked targets.

3. Number of incorrectly marked targets or friendly vehicles.

4. Specific targets missed (not marked).

5. Specific friendly vehicles marked as enemy targets.

6. Sixty (60) second time limit per scenario.

OBJECTIVES

Lesson Number: 7 Lesson Title: Hitting the Target

Topic: A. Hitting the Target

Topic training time: 30 min. Clas:U

Enabling Objective		Complete
10.	GUIDE MISSILE DURING TERMINAL PHASE	X
10.01	LOCK MISSILE ON SELECTED TARGET	X
10.01.02	SLEW CROSSHAIRS ONTO TARGET AND MAINTAIN THEM ON TARGET	X
10.01.03	PERFORM AND VERIFY TARGET LOCK-ON.	X
10.01.04	RECOGNIZE FAILURE OF MISSILE TO LOCK ONTO SELECTED TARGET	X
10.02	BREAK TARGET LOCK-ON	X
10.02.01	STATE REASONS TO BREAK TARGET LOCK-ON	X
10.02.02	STATE PROCEDURE TO BREAK TARGET LOCK-ON	X
10.02.03	SWITCH AUTOTRACKER FROM ONE TARGET TO A MORE DESIRABLE TARGET IF TIME PERMITS	X
10.02.03.01	DETERMINE THAT AN ALTERNATIVE TARGET IS WORTH BREAKING LOCK-ON TO SWITCh AUTOTRACKER	X
10.02.03.02	BREAK LOCK-ON AND SWITCH TO UNGUIDED CRUISE IF TARGET IS IDENTIFIED AS NON-TARGET	X
10.03	STEER MISSILE INTO TARGET MANUALLY	X
10.03.01	MANUALLY GUIDE MISSILE TO STATIONARY TARGET, IN CASE OF AUTOTRACKER OR CORRELATOR FAILURE	X
10.03.02	MANUALLY GUIDE MISSILE TO MOVING TARGET, IN CASE OF AUTOTRACKER OR CORRELATOR FAILURE	X

COURSEWARE OUTLINE

Lesson Number: 7 Lesson Title: Hitting the Target

Topic: A. Hitting the Target

Topic training time: 30 min. Clas:U

Content	Notes
1. Lesson introduction frame, time estimate, and narrative of topics to be covered. Topic 7A teaches how to lock the seeker on to a target or guide the missile manually until target impact.	
2. Narrative discussing the terminal phase of missile flight: a. Descent to target. b. Once started downward it is difficult to redirect the missile. c. Missile under power, very rapid progress to target. d. Duration of typical terminal phase. e. Terminal phase initiated by lock-on followed by seeker angle reaching 15 degrees below horizontal. f. Possibility of breaking lock-on in order to avoid a friendly or to select an alternative target. g. Possibility of guiding missile to target manually if lock-on fails or if a late decision is made to break lock-on.	Series of line drawings showing missile entering terminal phase. Represent missile altitude above ground.
3. Frame sequence and narrative describing the following procedures: a. Lock-on. i. SLEW cross hairs on target. ii. Press JOYSTICK trigger. iii. Verify lock-on by noting gates and watching missile make adjustments. b. Break lock-on. i. Press JOYSTICK trigger. ii. Verify breaking lock-on by noting that gates disappear and that missile proceeds past target. iii. Reasons to break lock-on. iv. Time required for alternative actions.	Line drawing of the video display just before and just after lock-on, and just before and after breaking lock.

4. Demonstration scenario in which the gunner observes the following events (no action required on the part of the gunner): a. Successful lock-on and impact. b. Unsuccessful lock-on attempt. c. Successful break of lock-on followed by lock-on to an alternative target. d. Unsuccessful break of lock-on due to late decision.	Use actual scene video. This is a dynamic scenario, in which the missile flies over the range and encounters targets.
5. Target tracking practice using geometric figures. The gunner practices slewing the seeker cross hairs onto the geometric figure and maintaining the cross hairs on the figure. a. Fixed size target, nonmoving. b. Target that enlarges, indicating time elapsed; nonmoving. Fixed amount of time to center cross hairs. c. Fixed size target, moving. d. Enlarging target, moving. Fixed amount of time to center cross hairs.	Repeat until standard is met. Performance measurement is discussed following this item. Gunner is prompted to track a (system specified) geometric figure. The gunner must maintain the seeker cross hairs on the center of mass on the figure for a minimum of five seconds. The gunner must also acquire the figure within five seconds. If the gunner fails to acquire the figure within the required time, the system cues the gunner to retry. If the gunner fails to maintain the seeker cross hairs on the center of mass on the figure, the system cues the gunner that he is losing track. If the cross hairs fall off the figure, the system prompts the gunner to retry and records the error.

At the end of the practice, the gunner is scored. If the gunner's score is below 90 percent, the gunner is cued and retakes the unsatisfactory (error) portion of the practice.

6. Performance practice scenarios designed to give opportunity to achieve lock-on and break lock-on: a. Stationary targets. b. Moving targets. i. Away from missile. ii. Toward missile. iii. At right angles to missile. iv. Under cover. c. High priority targets appearing late in the scenario. d. Perform all of above under conditions of obscuration or camouflage.	This is a dynamic simulation, requiring realistic video and some missile control. Repeat until standard is met. Performance measurement is discussed in outline. Gunner must acquire the system-prompted target and achieve a lock-on within ten seconds. If the gunner fails to acquire and lock on the target within the required time, or if he locks onto the wrong target, the system prompts the gunner to retry. Randomly, the system will prompt the gunner to break lock on a particular target. The gunner must break lock prior to missile impact. Also, the gunner is prompted to break lock-on for one target and acquire and lock onto another target specified by the system. This break lock or lock-on must be accomplished prior to missile impact. If the gunner fails to break lock or break lock and lock outs another target, the system prompts the gunner to retry. If the gunner fails the retries, the system records the error portions of the practice and cycles to the next scenario.

At the end of the practice, the gunner is scored. If the gunner's score is below 90 percent for the entire practice, the gunner is cued and retakes the practice. The gunner may choose not to retake the practice.

PERFORMANCE MEASUREMENT

LESSON: 7 Hitting the Target

TOPIC: A. Hitting the Target

ITEM: 5

Target tracking practice using geometric figures. The gunner practices slewing the seeker cross hairs onto the geometric figure and maintaining the cross hairs on the figure.

DISCUSSION: Center the seeker cross hairs on a geometric and hold them there for five (5) seconds. As the figure changes, each scenario has three (3) figures of various types (e.g., rectangle, triangle, square, circle). Each figure is to be available on the screen for ten (10) seconds. Each scenario increases in difficulty as follows:

a. Fixed size figures initially off center of screen. These three (3) figures each appear at ten (10) second intervals and at different positions on the screen.

b. Figures increasing in size, indicating seeker is approaching. These three (3) figures are initially off center of screen, appear at ten (10) second intervals, and at different positions.

c. Fixed size figures, initially off the screen, that move across the screen. These three (3) figures each appear at ten (10) second intervals, initially at different starting positions, and go in different directions.

d. Figures increasing in size, indicating seeker is approaching and moving across the screen. These three (3) figures each appear at ten (10) second intervals, at different starting places, and go in different directions.

At the end of each scenario, show a bar graph and accompanying text. The bar graph has each target labeled on the bottom axis and the total time each figure was on screen, ten (10) seconds, on the vertical axis. The bar indicates total time the seeker cross hairs were centered on the figure. The text indicates the longest continuous period the cross hairs were centered on each target. Give feedback at the end of each scenario. At the end of scenario (d), give composite feedback for all four (4) scenarios and allow more practice or continuation of the lesson.

EQUIPMENT REQUIRED: Dynamic and static video presentations of geometric figures, seeker SLEW control.

GUNNER REQUIRED ACTION: Center the seeker cross hairs and keep them in the center of the figures for five (5) seconds.

PERFORMANCE MEASUREMENT: The system monitors how long the seeker cross hairs remain centered on the figure. Each figure is shown for ten (10) seconds. The acceptable position range for the center of the figure is an area of reasonable proportion to the figure size around its center (about 1/2 the total target area). Thus, as long as the seeker cross hairs' center is positioned in this area, the cross hairs are centered. Measure the time the cross hairs remain on the center area of the figure.

PERFORMANCE MEASURES:

1. Ten (10) second time limit per figure.

2. Total seconds the gunner centers cross hairs.

3. Longest continuous period the cross hairs were centered on each target.

PERFORMANCE MEASUREMENT

LESSON: 7 Hitting the Target

TOPIC: A. Hitting the Target

ITEM: 6a.

Performance practice scenarios designed to give opportunity to achieve lock-on and break lock-on.

DISCUSSION: The system presents a target area containing five (5) stationary targets. The position and aspect of the targets vary. The gunner is instructed to use any seeker video display controls necessary to locate, select, and lock onto as many targets as possible within a 30 second time limit per scenario. The final measure is the number of targets locked onto during the time limit.

In order to achieve a lock-on, the seeker cross hairs must be on the selected target and the JOYSTICK trigger pulled. A correct lock-on is achieved if the cross hairs are centered on the main mass of the target, that is, the body of the target, (as defined in item 5). Successful completion of this item, locking onto all five (5) targets within the time limit, will cause the system to ask the gunner if he wants to practice with another scenario or continue onto the next item.

Once the lock-on is achieved, the system gives an audible beep, releases the lock-on, and highlights or removes the target. If this is a multiple target presentation, this target is no longer available for subsequent lock-ons.

EQUIPMENT REQUIRED: For this item, the gunner will need the following: Dynamic video with five (5) stationary targets, all seeker and missile controls.

GUNNER REQUIRED ACTION: Correct lock-on procedures.

PERFORMANCE MEASUREMENT: Measure number of targets locked onto. Lock-on errors are recorded for feedback at the end of each scenario. Feedback reports number of good lock-ons, number of bad lock-ons, specific targets not locked onto correctly, and failure to meet time limits. The gunner selects whether or not to continue or retry this item.

PERFORMANCE MEASURES:

1. Whether the gunner has locked onto a specified area of the target during the dynamic video presentation.

2. Number of correct lock-ons.

3. Number of incorrect lock-ons.

4. Specific targets missed (not locked onto).

5. Thirty (30) second time limit per scenario.

PERFORMANCE MEASUREMENT

LESSON: 7 Hitting the Target

TOPIC: A. Hitting the Target

ITEM: 6b.

Performance practice scenarios designed to give opportunity to achieve lock-on and break lock-on.

DISCUSSION: This item is similar to item 6a, but with moving targets. There are eight (8) directions of movement represented in the scenarios. The directions are as follows:

1. Away from missile,
2. Toward missile,
3. Across scene from right to left,
4. Across scene from left to right,
5. Obliquely from right front to left rear,
6. Obliquely from left front to right rear,
7. Obliquely from right rear to left front,
8. Obliquely from left rear to right front.

There are three levels of difficulty: (1) one moving target to lock onto, (2) two moving targets to lock onto, and (3) three moving targets to lock onto. Ten (10) seconds per target are allowed for lock-on. A scenario with three targets allows thirty (30) seconds to lock onto all three (3) targets, while a scenario with one target only allows ten (10) seconds to achieve lock-on. The same lock-on criteria are used as in item 6a. The gunner must successfully complete the scenario with difficulty (1) before moving up to the difficulty (2) level and successfully complete level (2) before moving to level (3). After level (3) the gunner may choose more targets or continuation to the next item.

EQUIPMENT REQUIRED: Dynamic video with moving targets, all seeker and missile controls.

GUNNER REQUIRED ACTION: Correctly lock onto moving targets.

PERFORMANCE MEASUREMENT: Ability to lock onto targets within the time limit. Monitor cross hairs for a good lock-on, using criteria as in the previous item. Once a good lock-on is achieved, the system gives an audible beep, releases the lock-on, and highlights or removes the target. This target is not available for subsequent lock-ons. Lock-on errors are recorded and given as feedback at the end of the scenario at each level. Feedback reports number of correct lock-ons, number of incorrect lock-ons, the specific targets not locked onto, and time limit overruns.

PERFORMANCE MEASURES:

1. Whether the gunner has locked onto a moving target within the specified area during a dynamic video presentation.

2. Number of correct lock-ons.

3. Number of incorrect lock-ons.

4. Specified targets missed (not locked onto).

5. Ten (10) second time limit per target.

PERFORMANCE MEASUREMENT

LESSON: 7 Hitting the Target

TOPIC: A. Hitting the Target

ITEM: 6c.

DISCUSSION: This item will follow closely with items 6a and 6b. In this item, however, the gunner enters a target area containing three (3) large cargo trucks with field guns in tow. After the gunner locks onto one of the trucks, a tank appears from behind some concealed position. The gunner must break the lock-on of the truck and proceed to lock onto the tank.

The instructions to the gunner before starting this item should be to lock onto the target with the highest priority. The gunner will have ten (10) seconds to break lock-on and lock onto the tank from the time the tank appears on the scene. The gunner is not stopped if he has exceeded the time limit; instead, the system just keeps track of how long he takes to achieve the lock-on of the truck, and then the break lock-on and lock-on of the tank. Completion of this item causes the system to ask the gunner if he wants to practice another scenario or continue to the next item.

EQUIPMENT REQUIRED: Dynamic video with three (3) moving cargo trucks, field guns in tow, and a concealed tank that moves into the open.

GUNNER REQUIRED ACTION: Lock onto the cargo truck within ten (10) seconds, then break the lock-on and lock onto the tank within ten (10) seconds after it first appears. Failure to do either within the time limit causes the system to provide the gunner with another similar scenario until he successfully completes one. After three (3) scenarios, the gunner is asked if he wants to practice further or continue, regardless of the results of the previous scenario.

PERFORMANCE MEASUREMENT: The ability of the gunner to achieve lock-on of the truck in the ten (10) seconds, and the ability to break lock-on and then lock onto the tank in ten (10) seconds are monitored during each scenario. Errors are recorded for feedback at the end of each scenario.

The feedback contains the number of trucks locked onto correctly, number of break locks and lock-ons of tanks done correctly, the specific trucks missed (not locked onto correctly), the specific tanks not locked onto correctly, and any time limit overruns.

PERFORMANCE MEASUREMENT

PERFORMANCE MEASURES:

1. Whether the gunner has locked onto a moving target within the specified area during the dynamic video presentation.
2. Number of correct truck lock-ons.
3. Number of correct tank lock-ons.
4. Number of correct truck lock-ons broken.
5. Number of incorrect truck lock-ons.
6. Number of incorrect tank lock-ons.
7. Number of incorrect truck lock-ons broken.
8. Specific items in error.
9. Ten (10) second time limit per lock-on.

COURSEWARE OUTLINE

Lesson Number: 7 Lesson Title: Hitting the Target

Topic: B. Performance Test

Topic training time: 15 min. Class:U

Content	Notes
1. Performance scenario of missile in cruise with target area in sight. Gunner must demonstrate the capabilities to achieve lock-on and break lock-on in the following situations: a. Stationary targets. b. Moving targets. i. Away from missile. ii. Toward missile. iii. At right angles to missile. iv. Under cover. c. High priority targets appearing late in the scenario. d. Perform all of above under conditions of obscuration or camouflage.	This is a dynamic simulation, requiring realistic video and some missile control Tell gunner the specific item to practice from the previous topic, if he fails an item here. Gunner must lock onto all system presented targets within 10 seconds. If lock-on is not achieved within the required time, the system prompts the gunner to retry. If the gunner fails to achieve lock-on during the second attempt, the system records the error (failure to lock-on) and cycles to the next scenario. At the end of the test, the gunner is scored for each category of target (stationary, moving, etc.) presented during the test. If the gunner's score is below 90 percent in any category, the gunner is cued and retakes the unsatisfactory (error) portions of the test.

The gunner may choose not to retake the test.

OBJECTIVES

Lesson Number: 8 Lesson Title: Missile Impact Assessment

Topic: Missile Impact Assessment

Topic training time: 15 min. Clas:U

Enabling Objective		Complete
11.	ASSESS IMPACT	X
11.01	OPERATE VIDEO RECORDER	X
11.01.01	RECORD SEEKER VIDEO FROM MISSILE	
11.01.01.01	STATE PROCEDURE TO RECORD SEEKER VIDEO	X
11.01.02	DEMONSTRATE ABILITY TO OPERATE VIDEO RECORDER IN PLAYBACK MODE	X
11.01.02.01	STATE PROCEDURES TO OPERATE VIDEO RECORDER IN PLAYBACK MODE	X
11.02	VIEW THE RECORDED SEEKER VIDEO AND ASSESS TARGET DAMAGE	X
11.02.01	STATE METHODS FOR ASSESSING TARGET DAMAGE	X
11.02.01.01	STATE EVIDENCE FOR TARGET DAMAGE	X
11.02.02	REVIEW VIDEOTAPE OF THE TERMINAL PHASE AND IMPACT OF THE SUBJECT MISSILE	X

COURSEWARE OUTLINE

Lesson Number: 8 Lesson Title: Missile Impact Assessment

Topic: Missile Impact Assessment

Topic training time: 15 min. Clas:U

Content	Notes
1. Lesson introduction frame, time estimate, and narrative of topics to be covered. Lesson 8 teaches how to record and use video from the impact missile and from another missile used in reconnaissance, in real time and on videotape, to determine the result of missile impact.	
2. Narrative discussing impact assessment. Present the following topics: a. Reasons for performing impact assessment. b. Real-time and videotaped impact assessment. c. Video from impacting missile and video from reconnaissance missile.	
3. Frame sequence and narrative presenting procedures to operate tape recorder/player: a. Videotape loading/unloading. b. Record. c. Playback. d. Fast forward. e. Rewind. f. Freeze.	Line drawing of tape recorder with
4. Frame sequence and narrative presenting: a. Strategies to perform impact assessment using videotape. b. Features of impact to pay attention to in order to make a decision about missile effectiveness (evidence of target damage). c. Specific features of impact to pay attention to during actual impact (as opposed to videotape playback assessment). d. Specific features of impact to pay attention to if reconnaissance video is available. e. Discussion of actions to take if problems occur with video playback.	Use impact video

5. Ask if each hit was or was not lethal.	
Scenarios of missile impact:	Use impact video.
a. Real-time assessment of impact video.	
b. Video playback assessment of impact video.	Use videotape. Give both lethal and non-lethal strikes and misses, pre-recorded. List relevant assessment features after each assessment, whether gunner is correct or incorrect. Performance measurement is discussed following this item.
c. Video playback assessment of reconnaissance video.	
	The gunner responds to prompts from the system as to whether the missile strike on a particular target was lethal, non-lethal, or a miss. The gunner must access the missile strike within ten seconds. If the gunner fails to call the strike in the required time or fails to assess the strike correctly, the system records the failure and cycles to the next scenario. This procedure is continued to the end of the practice at which time the gunner is scored on the timeliness and accuracy of his assessments. If the gunner's score is below 80 percent for the practice, he is cued and retakes the error portions of the practice. The gunner may choose not to repeat the practice.

PERFORMANCE MEASUREMENT

LESSON: 8 Missile Impact Assessment

TOPIC: Missile Impact Assessment

ITEM: 5

Ask if each hit was or was not lethal. Scenarios of missile impact:

a. Real-time assessment of impact video.
b. Video playback assessment of impact video.
c. Video playback assessment of reconnaissance video.

DISCUSSION: In this item, the gunner is asked to observe a series of simulated missile engagements from cruise to impact. The gunner does not control this missile but must record the video on the recorder. After missile impact, the gunner is asked if the missile hit the target. The gunner is instructed to replay the video to be certain the missile did hit the target. Next, if the gunner answered correctly, he is placed in control of a reconnaissance missile in the same target area. The gunner locates the target engaged by the first missile and records the scene video from the reconnaissance missile on the recorder. If the reconnaissance video does not support the earlier impact assessment of a target hit, he must lock onto and try to hit the target again or search for other targets if the original target was destroyed. The last requirement for the gunner is to replay the reconnaissance video and respond to a cue as to the target's destruction.

EQUIPMENT REQUIRED: For this item, the gunner will need the following: dynamic video, video recorder with playback capabilities, all seeker and missile controls for the reconnaissance missile, data entry keys for cued response.

GUNNER REQUIRED ACTION: Correct recording and playback procedures, correct cue responses, correct lock-on procedures (see Lesson 7, Topic A, Item 6).

PERFORMANCE MEASUREMENT: The gunner is monitored during each scenario for correctly responding to cues about the missile impact and correctly controlling the reconnaissance missile. The gunner must state whether or not a missile impact was or was not lethal.

Cue Response - the cue must be as follow: Target hit by missile?
1 - Yes 2 - No

Reconnaissance Missile Control: The gunner must achieve lock-on and hit the target if the target was not hit by the preceding missile.

PERFORMANCE MEASURES:

Gunner states whether impact was lethal or not lethal to target.

OBJECTIVES

Lesson Number: 9 Lesson Title: Full Mission Simulation

Topic: Full Mission Simulation

Topic training time: 30 min. Clas:U

Enabling Objective		Complete
12.	PERFORM A FULL FOG-M MISSION	X

COURSEWARE OUTLINE

Lesson Number: 9 Lesson Title: Full Mission Simulation

Topic: Full Mission Simulation

Topic training time: 30 min. Clas:U

Content	Notes
1. Lesson introduction frame, time estimate, and narrative of topics to be covered. Lesson 9 integrates the elements of launch, control, and assessment taught in this demonstration course.	
2. Full mission simulation, starting from pre-launch. Allow the gunner to select mission type and obscuration or clear target area. a. Fire on Azimuth. b. Fire on Coordinates. c. Fire on Pre-planned route. d. Target obscuration. e. Flight deviations.	The gunner should have a reasonable amount of control over the missile path. Performance measurement is discussed following this item. Gunner selects type of mission and level of obscuration and whether flight deviations will occur. System prompts the gunner with all mission information. System cues the gunner to begin the mission. For example, if the gunner selected the Fire on Azimuth mission, then he must complete the following procedure: 1. LCHR INIT (Press) 2. Verify LCHR DATA 3. "DATA OK?" (Press) 4. "TARGET AZ" (Press) 5. Verify AZ-1-ENTER AZ (Keypad) 6. "AZ OK?" (Press)

7. Verify #MSLS-1-
   ENTER #MSLS
   (Keypad)
8. "XX MSL OK?"
   (Press)
9. "ASF SW" (No Corr)
   (Press)
10. "RDY TO LAUNCH"
    (Press)
11. "TOGGLE FIRE SW"
    a. COUNT DOWN
    b. MSL IN FLT

After 60 seconds, if the gunner has not completed the launch procedure, but is not in error, then the system tells him that he has exceeded 60 seconds, but that he may proceed to completion. If he is in an error state at this time, or subsequently, then the system will prompt that he has made an error and will give him the opportunity to escape. In other words, the gunner may err during the first 60 seconds and recover on his own. After this time, each error will result in a message. If the gunner elects to escape, he may further decide to repeat the launch to go on to the next stage--Cruise. The other two missions will be checked in a similar fashion.

With the launch completed and the missile in Cruise, the gunner must recognize any

deviation in any of the missile flight parameters should they occur. If a flight parameter deviation occurs, the gunner must recognize the deviation and make adjustments to restore the missile's correct altitude/course. Gunner must recognize deviations and make adjustments within 10 seconds of their occurrence. It is, therefore, possible to crash the missile or to miss the target area. When the target area is visible, the gunner must lock-on to a target within 20 seconds. If the gunner fails to recognize the target area, the system records the error and continues the mission. The gunner selects a target and obtains a lock-on. If the gunner fails to lock-on to a good target, the system records the error and continues the mission.

The gunner observes seeker video as the missile proceeds to impact. The gunner may assess the missile impact at this time, or he may employ the system's video recorder to view the missile impact again. The gunner will assess the

impact as a kill, damaged, or a miss. Impact assessment must be completed within 60 seconds. If assessment is not made within the required time, the system records the error and continues with the mission. If the missile strike is a kill, the mission is completed, however, if the strike was a miss or only damaged the target, the gunner must select another launch within 60 seconds of the first strike.

At the end of the mission, the gunner must have:

1. Launched correctly within 60 seconds.
2. Flown successfully to the target area.
3. Detected the target area, selected an appropriate target, and locked-on to the target within 20 seconds.
4. Made a lethal strike.
5. Made the correct assessment of a lethal strike.

If the gunner has not completed these steps correctly and within the tolerances, the system prompts the gunner and tells him to retake the unsatisfactory (error) portions of the mission.

The gunner may choose to select another mission rather than retaking portions of the previous mission.

PERFORMANCE MEASUREMENT

LESSON: 9 Full Mission Simulation

TOPIC: Full Missile Simulation

ITEM: 2

Full mission simulation, starting from pre-launch. Allow the gunner to select mission type and obscuration or clear target area.

DISCUSSION: This item simulates missile launch to missile impact. There are three mission types: (1) fire on an azimuth, (2) fire on coordinates, and (3) fire on preplanned route. The gunner selects mission type and level of target area obscuration to be caused by fog, haze, smoke, or dust (3 levels).

There are three (3) stages to each mission: Stage 1, Launch Sequence; Stage 2, Cruise,Impact; and Stage 3, Impact Assessment. Stage 1, the launch sequence, follows the guidelines in Lesson 3, Topic C, Item 2. The type of launch sequence depends on the mission selected. Entire launch sequence must be completed within 60 seconds. Failure to complete within this time will not stop the mission sequence, but the failure is recorded.

Stage 2 is missile cruise to impact. The gunner identifies an enemy target and locks on according to the guidelines in Lesson 7, Topic A, Item 6A. The gunner observes the seeker video until impact.

Stage 3 is impact assessment. The gunner uses the system tools taught in Lesson 8.

A missed target counts as a failed Stage 2, and if the assessment of a missed target does not lead the gunner to reattack the same target, or if he reattacks a target that was hit by a previous missile, a failed Stage 3 is recorded. Reattacks are performed by either launching another missile or using an already airborne missile.

The gunner receives no prompting during the mission. After hitting three targets, the mission is over. Performance feedback is delivered, describing the failed items or aspects of performance and stating the lessons, topics, and items to be retaken for remediation.

The gunner can lock onto any part of the tank, or even the ground, in this item; however, if the lock-on is not on the target center, as described in Lesson 7, it is assumed that the missile misses the target.

EQUIPMENT REQUIRED: All gunner station equipment, dynamic video with multiple moving/stationary targets, video recorder with playback capabilities.

GUNNER REQUIRED ACTION: Launch each missile, control the missile, achieve lock-on, hit target, and assess impact results.

PERFORMANCE MEASUREMENT: Each launch sequence must be completed within 60 seconds. The rest of the mission consists of: locate, lock-on, and hit an enemy target; assess missile impact; and reattack if necessary. The system monitors the gunner during this mission sequence and records the errors for feedback, given after three (3) targets have been hit or six (6) targets have been presented. Total time to hit three targets is also reported.

PERFORMANCE MEASURES:

1. Whether launch sequence is completed within 60 seconds (from pressing first PDP, LAUNCH INIT., to operating FIRE toggle switch).

2. Whether lock-on occurred.

3. Whether the correct target was locked onto.

4. Whether target is hit.

5. Whether the gunner reattacks a missed target (targets must show they were hit by prior missile launches).

APPENDIX B

OBJECTIVES HIERARCHY FOR THE DEMONSTRATION FOG-M ET

Appendix B is a listing of all the training objectives relevant to the demonstration FOG-M. Each hierarchy page contains the following information:

NUMBER - Objective number.

L - Number of the lesson in which objective is closed out.

TITLE - Objective title.

CONDITIONS - Conditions for performance.

STANDARDS - Standards of performance.

SKILLS - Skills required.

KNOWLEDGES - Knowledges to be gained.

NOTE: In this database the term "DEMONSTRATION FOG-M SYSTEM" has been used. The FOG-M is not an Army system, but is simply a technology demonstration.

NUMBER	L	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
00.	1	STATE THE CONTENTS OF THE ET TRAINING COURSE FOR THE DEMONSTRATION FOG-M SYSTEM	None.	State the content of the demonsration FOG-M ET system training course.		
01.	1	UNDERSTAND THE FOG-M SYSTEM	None.	Recognize the facts.		
01.	1	STATE WHAT THE FOG-M SYSTEM IS	None.	Recognize the facts.		The FOG-M system is a fiberoptically controlled, video guided, mobile missile system.
01.02	1	STATE WHAT THE FOG-M SYSTEM DOES	None.	Recognize the facts.		FOG-M system fires single missiles or salvos at hardpoint targets such as tanks. Missiles can be automatically or manually guided. Phases of missile flight.
01.03	1	STATE THE MAJOR SUBSYSTEMS OF THE FOG-M SYSTEM	None.	Recognize the subsystems.		HMMWV,. missile launcher, missiles, gunner's console.
01.04	1	STATE WHAT IS NOTEWORTHY ABOUT THE FOG-M SYSTEM	None.	Recognize the key concepts.		Missile sends back video via fiberoptic link, automatic pattern recognition, real-time guidance via computer or human interface, embedded training maximizes gunner capability and hit rate.

NUMBER	L	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
01.05		STATE THE BENEFITS OF THE FOG-M SYSTEM OVER OTHER SYSTEMS DESIGNED TO PERFORM SIMILAR TASKS	None.	Recognize benefits of the FOG-M system.		ECM proof, nonradiating data link, lower cost to smart missile due to conservation of computer, mobility using HMMWV, ability to hit unseen targets, natural control loop (video and steering), longer range, no external real-time spotter.
01.06	1	STATE THE CAPABILITIES OF THE FULL FOG-M SYSTEM	None.	State the capabilities.		Land nav via VNAS or FOG-M sys. mission planning & waypoints, auto launch sequence, multi.launch, correlator, auto track, map, MAN control, video record/play, seeker scan, attitude stabilization, alt. control, BITE, recon., user interface.
01.06.01	1	STATE FUNCTIONAL CAPABILITIES OF THE FIELDED FOG-M SYSTEM	None.	State the capabilities.		Automatic land nav., mission planning and waypoints, auto launch sequence. multiple launch, pattern recognition, map, manual control, simple user interface, video view, recon capability, video record/play.

NUMBER	L	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
01.05.02	1	STATE THE EQUIPMENT CAPABILITIES OF THE FIELDED FOG-M SYSTEM	None.	State the capabilities.		Land nav via VNAS and FOG-M land nav. mode, video recorder, autotrack, map display, seeker slew, independent altitude control, seeker independent or slaved to seeker, correlator, salvo, BITE, launcher based computer, fiberoptic link.
01.07	1	STATE THE CURRENT SKILLS TO BE TRAINED [illegible] FOR THE FIELDED FOG-M SYSTEM	None.	State the skills to be trained.		Tracking, target recognition/discrimination/ prioritization, map reading, map symbology related to video, simple procedures, missile control, mission/route planning, land nav., system deployment.
02.		UNDERSTAND EMBEDDED TRAINING (ET)	None.	Understand ET.		
02.01		DEFINE EMBEDDED TRAINING (ET)	None.	Recognize implications of the definition.		ARI definition of ET.
02.02		STATE THE BENEFITS OF EMBEDDED TRAINING (ET)	None.	Understand the benefits of ET.		Follows and enhances formal school, reduces instructor requirement, goes with the system to be trained, gives feedback, can be included in full scale operational simulations.

		CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
02.03	[illegible]	None.	Understand how ET fits into the FOG-M system.		ET provides refresher training practice without firing a missile, ET allows cross training in the field, ET allows practice on likely terrain, ET is implemented fully into the planned computational capability.
03.	UNDERSTAND THE CAPABILITIES OF THE DEMONSTRATION FOG-M SYSTEM	None.	State the capabilities.		
03.01	STATE THE [illegible] CAPABILITIES OF THE DEMONSTRATION FOG-M SYSTEM	None.	State the functional capabilities.		Missile launch, cruise, terminal, impact assessment phases, MAN/AUTO NAV control, recon., pattern recognition, gunner interface, all firing modes, map display.
03.02	STATE THE EQUIPMENT CAPABILITIES OF THE DEMONSTRATION FOG-M SYSTEM	None.	[illegible] the equipment capabilities.		Video, video recorder, computer, seeker slew video, missile firing in special demonstration, gunner interface software, map display, autotrack.

		CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
01.01	STATE THE LIMITATIONS OF THE DEMONSTRATION FOG-M SYSTEM	None.	State the limitations.		Mission preplanning by support staff, no actual missile, no salvo, no multiple missile video, no auto. multi. missile launch sequence.
01.04	UNDERSTAND HOW ET FITS INTO THE DEMONSTRATION FOG-M SYSTEM	None.	Understand the situation.		ET is the only training for the FOG-M system demonstration, ET allows many persons to see how the missile is operated, though few actual firings will take place.
01.05	STATE THE GUNNER SKILLS TO BE TRAINED FOR THE DEMONSTRATION FOG-M SYSTEM	None.	State the skills to be trained.		Launch procedures, seeker use, missile flight control, missile navigation, target detection/selection, terminal phase guidance, assess impact, AUTO/MAN NAV, missile flight phase, map symbology related to video.
04.	UNDERSTAND AND RECOGNIZE FOG-M SYSTEM EQUIPMENT, UNDERSTAND FUNDAMENTAL FOG-M PARAMETERS	None.	Understand FOG-M system equipment and FOG-M parameters.		

[illegible]	[illegible]	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
04.01	2 STATE THE FUNDAMENTAL PARAMETERS OF THE DEMONSTRATION FOG-M SYSTEM.	None.	Understand the parameters of the demonstration FOG-M system.		
04.02	2 STATE LOCATIONS OF ALL CONTROLS THAT ADJUST SEEKER VIDEO	Given the FOG-M system gunner's console.	Name and locate each control.		Location of iris, contrast, and brightness controls.
04.02.01	2 STATE ADJUSTMENTS TO BE MADE TO SEEKER VIDEO	Given the FOG-M system gunner's console.	State the functions of each control.		Iris, contrast and brightness control functions/locations.
04.03	2 STATE THE CONTROLS THAT CONTROL ALTITUDE, PITCH, ROLL, AND AZIMUTH (YAW).	Given the FOG-M system gunner's console.	Identify the controls correctly.		Altitude, pitch, roll, and azimuth (yaw) control functions/locations.
04.04	2 STATE THE FUNCTIONS REQUIRED TO OPERATE THE DEMONSTRATION FOG-M SIMULATED MISSILE	Given a choice of possible functions.	Recognize the functions at a 90% level of accuracy.		Phases of flight, target detection, contingencies, impact assessment.
04.05	2 NAME EACH CONTROL AND DISPLAY ON THE FOG-M CONSOLE AND STATE ITS FUNCTION	Given the FOG-M system console.	State correctly 90% of the items.		

NUMBER	L	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
04.05.0*	2	NAME EACH CONTROL AND DISPLAY ON THE FOG-M SYSTEM CONSOLE	Given the FOG-M system console.	Name 90% of the items correctly. Descriptive names are acceptable.		Names of all items.
04.05.02	2	STATE THE FUNCTION OF EACH CONTROL AND DISPLAY ON THE FOG-M SYSTEM CONSOLE	Given the FOG-M system console.	State the functions correctly for 90% of the items.		Functions of all equipment. Knowledge of the general operation of FOG-M.
05.	3	PERFORM LAUNCH PROCEDURES	Given the FOG-M ET system.	Perform 5 successive launches successfully without assistance.		
05.0[illegible]	3	FIRE MISSILE (ABORT, HOLD, OR LAUNCH)	Given the FOG-M ET system, required launch data, and available missiles.	Perform at 100% level.		Missile firing procedures.
05.01.01	3	SELECT LAUNCH FUNCTION	Given the FOG-M ET system.	Perform at 100% level.		Procedure for selecting the launch function.
05.01.01.01	3	STATE LAUNCH SELECTION PROCEDURE	Given the FOG-M system gunner's console.	State that procedure consists of pressing launch PDP.		Location of launch PDP, correct procedure.
05.01.0[illegible]	3	CONFIRM OR CORRECT EXISTING LAUNCHER DATA (LAUNCH SITE, LAUNCHER HEADING)	Given the FOG-M ET system and the correct data.	Perform at 95% correct level.	Use of joystick or keypad.	Procedures for determining, confirming, or entering data.

NUMBER	L	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
05.01.01	3	ENTER MISSILE GUIDANCE DATA (MISSION TYPE, TARGET NUMBER, ROUTE NUMBER, TARGET COORDINATES, MISSILE HEADING AND AZIMUTH)	Given the FOG-M ET system and missile guidance data or fire mission.	Perform at 95% correct level.	Determining mission type, using PDP, using joystick, using keypad, map reading.	Procedure to enter missile guidance data (mission type, target number, route number, target coordinates, missile heading).
05.01.01.01	3	DETERMINE MISSION TYPE	Given a fire mission.	State the three mission types.	Select azimuth/range only, preplanned, or target coordinates, determining mission type.	Procedure for determining mission type (appropriate firing mode) and data required for each mission type.
05.01.01.02	3	OPERATE PDP'S	Given the FOG-M ET system and an appropriate point in the missile launch sequence.	Respond to prompts correctly.		How the PDP's light up and what flashing lights mean
05.01.04	3	CONFIRM THAT ENOUGH MISSILES ARE AVAILABLE FOR MISSION	Given FOG-M ET system that fires only one missile per mission.	Perform at 100% level.	Display mission status tableau, verify number of missiles present.	Procedure for displaying missile status tableau.
05.01.05	3	SELECT CORRELATOR IF DESIRED	Given the FOG-M ET system and a simulated preflown mission with which to correlate.	Gunner must know that preplanned or nonplanned missions can use correlator if video data are available.	Select correlator, determining when correlator is appropriate.	Procedure for manually selecting correlator, how to determine if correlator is appropriate.

[illegible]	L	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
05.01.04	3	LAUNCH MISSILE	Given the FDC-M ET system, one or more available missiles, and clear launch conditions.	Fully successful launch.	Determining when all preconditions for launch have been met	Procedure to launch missile.
05.02	3	RESPONSE TO SELECTED MAJOR CONTINGENCIES FOR MISSILE LAUNCH	Given FDC-M ET system and random problems during launch.	React correctly at 100% level, in time to take action.		Recognition of contingency situations and procedures for response.
05.02.01	3	STATE MAJOR CONTINGENCIES DURING MISSILE LAUNCH	Given the FDC-M system gunner's console.	State both contingencies.		Missile fails to fire, missile hangs up.
05.02.02	3	ABORT LAUNCH OF MISSILE	Given the FDC-M ET system and indications for abort.	Perform abort before missile fires.	Perform abort determination and procedure.	Procedure to abort launch, indications for launch abort.
05.02.03	3	RESPOND TO FAILURE OF MISSILE TO FIRE	Given the FDC-M ET system, and simulated missile failure.	Begin firing of next missile within 1 minute of failure.		Procedure for failed missile firing, automatic actions that may occur after failure, manual actions that may be taken.
05.02.03.01	3	STATE RESPONSE TO FAILURE OF MISSILE TO FIRE	None.	State correctly in order.		Indications of missile failure to fire, appropriate response to missile failure to fire.
05.02.04	3	STATE RESPONSE TO HUNG MISSILE	Given the FDC-M ET system and simulated hung missile.	State the four steps in order and without error.		Procedure for hung missile 1. Open circuit breaker. 2. Remove hung missile from launcher. 3. Close circuit breaker. 4. Fire next missile.

NUMBER	L	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
04.	4	USE THE SEEKER	None.	None.		
04.04	4	ADJUST SEEKER VIDEO	Given FOG-M system and a variety of seeker video scenes.	Adjust to optimize visual perception of scene.	Adjust seeker video as appropriate.	Controls used to adjust seeker video, procedures adjust seeker video.
04.01.01	4	ADJUST BRIGHTNESS AND CONTRAST OF VIDEO DISPLAY	Given the FOG-M ET system and video display.	Adjust to desired level.	Adjust video display when necessary.	Location and operation of brightness/contrast controls on the gunner's console, appropriate vide level for best navigation and target discrimination
04.01.02	4	SELECT APPROPRIATE SEEKER IRIS DIAMETER	Given the FOG-M ET system and a variety of target area scenes of varying brightness.	Adjust so wide range of targets is identifiable quickly.	Quickly adjust iris to optimize seeker video contrast.	Location and operation of MAN/AUTO and OPEN/CLOSE IRIS switches on gunner's console.
04.01.02.01	4	STATE ACTIONS TO TAKE WHEN SEEKER IRIS ADJUSTMENT FAILS.	Given the FOG-M ET system, seeker video with simulated iris failure in various light conditions.	State actions correctly.		Procedures to invoke (change course, look away from sun, adjust CRT brightness and contrast).
04.02	4	OPERATE SEEKER SLEW TO OBSERVE FEATURES	Given the FOG-M ET system and simulated cruise.	Operate seeker smoothly.		Procedure to operate slew without altering missile cruise parameters, and maximize use of seeker video.

NUMBER	L	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
06.01.03	4	MAINTAIN KNOWLEDGE OF ORIENTATION OF SEEKER VS. MISSILE WHILE SEEKER IS SLEWED	Given the FOG-M ET system, simulated cruise, and seeker slewed from straight ahead.	Indicate position of seeker relative to missile within 45 degrees in any direction.	Ability to orient seeker vs. missile in space.	
06.01.02	4	SLEW SEEKER TO CENTER THE TARGET AREA ON THE VIDEO DISPLAY	Given the FOG-M ET system, simulated cruise with multiple target areas.	Center target area within 5 seconds of its appearance on the video display.	Manually slew seeker to center the target area, using joystick controls.	Procedure for switching manual missile navigati procedure for manually steering missile, locat of target.
06.01.03	4	STATE ACTIONS TO TAKE WHEN SEEKER DOES NOT SLEW	Given the FOG-M ET system, simulated cruise, and seeker slew function failure.	State procedures correctly.		Procedures to invoke.
06.03	4	OPERATE SEEKER ZOOM	Given FOG-M ET system, and simulated cruise.	Zoom in and out appropriately. Maintain orientation while using zoom.	Operate zoom without loss of missile orientation.	
06.03.01	4	STATE ACTIONS TO TAKE WHEN SEEKER ZOOM FAILS	Given the FOG-M ET system, seeker video, and simulated seeker zoom failure.	State actions correctly.		Procedures to invoke.
07.	5	CONTROL MISSILE FLIGHT	Given the FOG-M ET system and simulated cruise.	Navigate missile to within +/- X km of target area.		

NUMBER	L	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
07.01	S	USE MAP DISPLAY AND RELATE TO VIDEO	Given the FOG-M ET system gunner's console, seeker video, and computer generated map displays.	Relate map topography to seeker video at 100% level.	Map reading.	Map reading, map symbology related to seeker video.
07.01.01	S	SWITCH BETWEEN SEEKER VIDEO AND MAP DISPLAY	Given the FOG-M ET system gunner's console.	State/perform procedure without error.		Location of ALT DISP switch, procedure to switch between seeker video and map display.
07.01.02	S	IDENTIFY CORRESPONDING LANDMARKS ON MAP DISPLAY AND SEEKER VIDEO	Given the FOG-M ET system, still and moving seeker video of a specified region, and a map display of the same region.	Identify landmarks from map to seeker and vice versa, on moving video, on first viewing of video. Perform at 75% level.	Map reading.	Change display function, key features on map and video, map symbology, specific terrain (lay of the land) as represented on map.
07.02	S	ADJUST MISSILE PITCH, ROLL, AND ALTITUDE	Given the FOG-M ET system gunner's console, simulated cruise in manual mode.	Adjust within +/- 1 degree.		
07.02.01	S	ADJUST MISSILE PITCH	Given the FOG-M ET system and simulated cruise in manual mode.	Adjust within +/- 1 degree.	Operate joystick pitch/yaw/slew switch, coordinate with pitch readout on video display.	Procedure to adjust missile pitch by switching to MAN NAV, relationship of missile pitch to missile altitude, procedure to restore level cruise by restoring AUTO NAV.

TASK#	L	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
07.02.02	S	ADJUST MISSILE ROLL	Given the FOG-M ET system and simulated cruise in manual mode.	Maintain roll so that missile remains on course.	Operate console roll switch, coordinate with roll readout on video display.	Procedure to adjust missile roll, relationship of roll to missile flight.
07.02.03	S	ADJUST MISSILE ALTITUDE	Given the FOG-M ET system and simulated cruise in manual mode.	Maintain altitude above terrain.	Operate ALT INCR/ROLL switch.	Procedure to change altitude. ALT INCR/ROLL switch location, altitude readout.
07.03	S	MAKE ADJUSTMENTS TO MISSILE COURSE	Given the FOG-M ET system and simulated cruise	Adjust missile course to within +/- .5 degree.		
07.03.01	S	ADJUST AZIMUTH	Given the FOG-M ET system and simulated cruise in manual mode.	Reinstate missile azimuth to within +/- .5 degree.	Operate joystick yaw control and coordinate with heading readout.	
07.04		RESPOND TO INABILITY TO CONTROL MISSILE FLIGHT MANUALLY	Given the FOG-M ET system, simulated cruise, in manual mode, no response to control inputs.	Recognize loss of control within 5 seconds and complete check procedures within 30 seconds.		Procedure to check switch positions and control functions, write -up for post-mission report.
08.	S	NAVIGATE MISSILE	Given the FOG-M ET system, and simulated cruise.	None.		
08.01	S	VERIFY INITIAL CRUISE PARAMETERS	Given the FOG-M ET system and simulated cruise.	Verify cruise parameters within 10 seconds of onset.		Location of missile parameter readouts.
08.01.01	S	OBSERVE MISSILE PARAMETERS (PITCH, ROLL, ALTITUDE, AZIMUTH, FLIGHT PATH)	Given the FOG-M ET system and simulated cruise.	Recognize faulty parameters within 10 seconds of onset.		Location of missile parameter readouts.

NUMBER	L	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
08.01.01.01	5	MONITOR VIDEO DISPLAY TO CONFIRM THAT CORRECT INITIAL CRUISE ALTITUDE, ATTITUDE, AND COURSE HAVE BEEN ESTABLISHED	Given the FOG-M ET system and simulated cruise.	Verify and control pitch, roll, initial azimuth, and altitude.	Interpret video display to determine need for correction.	Proper ranges for missile altitude, attitude, and course, location of missile parameter readouts.
08.01.01.02	5	VERIFY CORRECT PITCH	Given the FOG-M ET system and simulated cruise.	Read pitch readout correctly.	Observe missile pitch	Location of pitch readout on video display, proper pitch and pitch range.
08.01.01.03	5	VERIFY CORRECT ROLL	Given the FOG-M ET system and simulated cruise.	Verify roll readout correctly.	Observe and adjust missile roll.	Location of roll readout on video display, procedure for manually adjusting missile roll, proper missile roll and roll range, location of ALT INCR/ROLL switch.
08.01.01.04	5	VERIFY CORRECT ALTITUDE	Given the FOG-M ET system and simulated cruise.	Verify altitude readout correctly.	Observe and adjust missile altitude.	Location of altitude readout on video display, procedure for manually adjusting missile altitude, proper altitude and altitude range, location of ALT INCR/ROLL switch.
08.01.01.05	5	VERIFY CORRECT INITIAL AZIMUTH	Given the FOG-M ET system and simulated cruise, perform immediately after pitchover.	Verify initial azimuth correctly at proper time.	Change missile heading, using joystick controls.	Location of azimuth readout on the video display, location of MAN/AUTO NAV switch and SLEW control on joystick, procedure for manually changing missile heading, precision required.

NUMBER	L	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
08.01.01.06	5	VERIFY HEADING CHANGES BY OBSERVING KEY LANDMARKS & SWITCHING TO MAP DISPLAY, ADJUST IF NECESSARY	Given the FOG-M ET system, simulated cruise, and assigned landmarks.	Navigate to target area at 95% level.	Find key landmarks on seeker video that correspond to selected landmarks on the map display, verify heading, adjust heading if necessary.	Procedure for obtaining map display, map symbology, procedure for changing missile heading, using joystick controls.
08.02	5	RESTORE MISSILE TO COURSE FOLLOWING AN ERROR IN AUTOMATIC OR MANUAL NAVIGATION	Given the FOG-M ET system and simulated cruise.	Navigate to within +/- X km of target area.	Manual control of missile, rapid map reading, recognition of landmarks ability to reestablish missile course.	Course to target area, procedures to institute manual control, procedures to reinstate automatic control, procedure to reestablish missile course.
08.02.01	5	DETERMINE REQUIRED CONTROL INPUTS FOR COURSE CORRECTION	Given the FOG-M ET system, missile off course (altitude, pitch, heading, roll)	Return to course so that missile arrives within +/- X km of target area, Y seconds prior to fuel termination.	Rapid map reading rapid recognition of landmarks.	Course to target area.
08.04	5	NAVIGATE WITH CORRELATOR	None.	None.		
08.04.01	5	VERIFY THAT CORRELATOR IS WORKING PROPERLY DURING AUTOMATIC CRUISE	Given the FOG-M ET system, simulated cruise, stored missile video from first missile.	Make assessment correctly.		Course reference points.

NUMBER	L	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
08.04.02	5	RECOGNIZE THAT CORRELATION HAS FAILED AND CAUSE OF FAILURE	Given the FOG-M ET system and failure of correlation during simulated cruise.	Recognize problem and make distinction within 15 seconds.	Ability to assess correlator failure.	Distinction between correlator failure and failure to achieve adequat index of correlation.
08.04.02.01	5	STATE DISTINCTION BETWEEN CORRELATOR FAILURE AND FAILURE TO ACHIEVE SATISFACTORY INDEX OF CORRELATION.	None.	State correctly.	Ability to discriminate between correlator failure and correlator malfunction.	Proper range of correlator index of correlation (similarity).
08.04.03	5	ADJUST PATH OF PROBLEM MISSILE TO REINSTATE CORRELATION WHEN PROBLEM IS LOW INDEX OF CORRELATION	Given the FOG-M ET system, low index of correlation during simulated cruise, and possibility of reinstating correlation.	Reinstate correlation at 75% level.	Manually steer missile to point where correlation will occur.	Procedure for selecting MA NAV, procedures for manually correcting missil attitude, altitude, & heading, characteristics o correlatorfailure, indications of correlator reinstatement.
08.04.04	5	NAVIGATE MISSILE MANUALLY WHEN CORRELATOR FAILS	Given the FOG-M ET system and failed correlator during missile cruise.	Navigate missile to target area +/- X km.	Navigate missile manually.	Procedure to switch to MAN NAV.
08.05	5	MONITOR VIDEO DISPLAY TO CONFIRM THAT PROGRAMMED HEADING CHANGES ARE MADE (AT WAYPOINTS)				

NUMBER	L	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
08.05.01	5	RETURN TO CORRECT COURSE FOLLOWING WAYPOINT CHECK ERROR	Given the FOG-M ET system and simulated cruise.	Perform correctly to within +/- .5 degrees.		Procedure to reinstate correct course.
09.	6	DETECT, RECOGNIZE, IDENTIFY TARGETS				
09.01	6	DETECT TARGET(S)	Given the FOG-M ET system, simulated cruise, possible targets, visual obscuration, camouflage.	Detect possible targets 100% of time, within 3 seconds of their appearance.	Ability to rapidly detect targets from other video images.	Visual cues indicating a possible target.
09.01.01	6	DISCRIMINATE TARGET AREA FROM BACKGROUND VIDEO	Given the FOG-M ET system, simulated cruise, targets, standard camouflage, and visual obscuration.	Discriminate target area 100% of the time.	Discriminate foreground objects from background, perform task under conditions of visual obscuration and camouflage.	Features that specify near and distant objects (edges, relative motion and other 3-dimensional cues, gradients.
09.01.01.01	6	KNOW VISUAL CUES THAT SUGGEST THAT A VISUAL PATTERN IS A TARGET	None.	Familiar with cues to three-dimensionality, ablity to discern camouflaged objects.	Ability to discern camouflaged objects.	Cues to three-dimensionality.
09.01.02	6	DETECT TARGETS THAT ARE CAMOUFLAGED	Given the FOG-M ET system and simulated cruise over targets using various forms of camouflage.	Identify targets 75% of the time that they are on the screen during standard cruise.	Ability to discriminate targets under various froms of camouflage.	Visual cues indicating the presence of targets.
09.01.03	6	DETECT TARGETS IN VISUAL OBSCURATION (SMOKE, VEGETATION, and FOG)	Given the FOG-M ET system and simulated cruise over targets obscured by smoke, vegetation, or fog.	Detect targets 75% of the time.	Ability to detect targets under various froms of obscuration.	Visual cues indicating the presence of targets.

NUMBER	L	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
09.0[illegible]	6	RECOGNIZE/IDENTIFY TARGET(S)			Determine priority of targets present.	Targets and priorities characteristics.
09.02.01	6	ZOOM IN ON TARGETS	Given the FOG-M ET system, cruise (+ obscuration) over multiple targets and non-targets, mixed throughout the cruise.	Zoom in on target within 5 seconds of its appearance on video display.	Determine promising targets from all target aspects under conditions of obscuration and target distractors, ability to center target areas, ability to discriminate targets from non-targets,	Characteristics of promising targets.
09.02.02	6	DISCRIMINATE BETWEEN BRIEFED TARGETS AND OTHER TARGETS THAT MAY BE PRESENT	Given the FOG-M ET system, single briefed target, alternative targets, obscuration.	Select briefed target correctly 9 out of 10 times.	Recognize the briefed target at all target aspects under conditions of obscuration and target distractors.	Characteristics of targets, characteristics of non-targets.
09.02.03	6	DIFFERENTIATE BETWEEN HIGH-PRIORITY AND LOW-PRIORITY ENEMY TARGETS	Given the FOG-M ET system, simulated cruise over multiple targets.	Assign targets to high or low priority, assign 9 out of 10 targets to the correct category.	Rapidly determine target priorities.	Factors and procedures to determine target priorities.
09 02.04	6	DIFFERENTIATE BETWEEN TARGETS AND FRIENDLIES	Given the FOG-M ET system and simulated cruise over targets and friendlies (non-targets).	Discriminate between targets and friendlies 100% of the time.	Differentiate between targets and friendlies, perform task under all target aspects, under conditions of obscuration and target distractors.	Characteristics of friendlies, characteristics of targets.

NUMBER	L	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
10.	7	GUIDE MISSILE DURING TERMINAL PHASE				
10.01	7	LOCK MISSILE ON SELECTED TARGET				
10.01.01	6	CHANGE TRACKER CONTRAST DIRECTION IF SELECTED TARGET IS BRIGHTER THAN BACKGROUND	Given the FOG-M ET system and targets of higher and lower brightnessthan the background.	Perform correctly 100% of the time.	Ability to descriminate contrast of target vs. background and vice versa.	Procedure to change tracker contrast.
10.01.02	7	SLEW CROSSHAIRS ONTO TARGET AND MAINTAIN THEM ON TARGET	Given the FOG-M ET system, simulated cruise over a single target, under conditions of obscuration.	Maintain crosshairs on target for 15 seconds out of 20, counted from first target centering.	Target tracking, perform under conditions of visual obscuration without breaking track on target.	Procedure to slew and maintain seeker/crosshairs on the target.
10.01.03	7	PERFORM AND VERIFY TARGET LOCK-ON.	Given the FOG-M ET system and target centered under crosshairs.	Perform correctly 100% of the time.	Target tracking.	Behavior of missile when locked and not locked onto target.
10.01.04	7	RECOGNIZE FAILURE OF MISSILE TO LOCK ONTO SELECTED TARGET	Given the FOG-M ET system, simulated terminal phase, failure to lock-on.	Recognize failure to lock-on within 5 seconds, 100% of the time.	Ability to recognize indications that the missile failed to lock onto selected target.	Characteristics of failure to lock-on target.
10.02	7	BREAK TARGET LOCK-ON	Given the FOG-M ET system, target lock-on, and simulated missile closing on target or non-target.	Perform correctly 100% of the time, within 15 seconds.		Reasons and procedures to break target lock-on.

NUMBER	L	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
10.02.01	7	STATE REASONS TO BREAK TARGET LOCK-ON	None.	State reasons correctly.		Reasons to break target lock-on.
10.02.02	7	STATE PROCEDURE TO BREAK TARGET LOCK-ON	None.	State procedure correctly.		Procedure to break target lock-on, reasons to break target lock-on.
10.02.03	7	SWITCH AUTOTRACKER FROM ONE TARGET TO A MORE DESIRABLE TARGET IF TIME PERMITS	Given the FOG-M ET system, simulated terminal phase, lock-on, alternative targets of higher priority.	Switch 80% of the time it is appropriate, hit some target (high or low priority) 90% of the time.	Break autotrack, using joystick trigger, lock onto new target.	Procedure for breaking autotrack, procedure for manually controlling missile flight, procedure for establishing lock-on, location of appropriate controls.
10.02.03.01	7	DETERMINE THAT AN ALTERNATIVE TARGET IS WORTH BREAKING LOCK-ON TO SWITCH AUTOTRACKER	Given FOG-M ET system, simulated terminal phase with target locked-on, alternative targets.	Selection with 10 seconds remaining to impact, make selection 80% of the time that it is appropriate.	Target priority assignment, assess adequacy of time available, break lock-on, center target, lock-on.	Target priorities, lock-on and break lock-on procedures.
10.02.03.02	7	BREAK LOCK-ON AND SWITCH TO UNGUIDED CRUISE IF TARGET IS IDENTIFIED AS NON-TARGET	Given the FOG-M ET system, lock-on, and target is identified as non-target.	Perform correctly within 5 seconds 100% of the time.	Break autotrack, using joystick controls, fly missile to alternate target or into ground.	Target vs. non-target characteristics, procedure for selecting MAN NAV, procedure for manually steering the missile.
10.03	7	STEER MISSILE INTO TARGET MANUALLY	Given the FOG-M ET system, target lock-on, unannounced failure of correlator or autotracker.	Assume manual control and guide missile to impact moving target 90% of time and to stationary target 100%.	Manual control of missile.	Symptoms of autotracker or correlator failure, procedure for switching to MAN NAV, procedure for manually steering missile, location of target.

NUMBER	L	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
10.03.01	7	MANUALLY GUIDE MISSILE TO STATIONARY TARGET, IN CASE OF AUTOTRACKER OR CORRELATOR FAILURE	Given FOG-M ET system, simulated terminal phase, target lock-on to stationary target.	Guide missile to target impact 100% of the time.	Manual control of missile.	Procedure for switching to manual missile navigation, procedure for manually steering missile, location of target.
10.03.02	7	MANUALLY GUIDE MISSILE TO MOVING TARGET, IN CASE OF AUTOTRACKER OR CORRELATOR FAILURE	Given the FOG-M ET system, terminal phase, no target lock-on.	Guide missile to actual target impact 90% of the time.	Manual control of missile.	Procedure for switching to manual missile navigation, procedure for manually steering missile, location of target.
11.	8	ASSESS IMPACT				
11.01	8	OPERATE VIDEO RECORDER				
11.01.01	8	RECORD SEEKER VIDEO FROM MISSILE	Given the FOG-M ET system, video recorder and video tape.	Load tape and operate video recorder at 100% level.	Operate video recorder to record. Load tape.	Procedures to operate video recorder to recorder, and procedures to load tape.
11.01.01.01	8	STATE PROCEDURE TO RECORD SEEKER VIDEO	None	State steps to record in correct order. State how to load tape.		Procedure to record seeker video, location of recorder controls/switches.
11.01.02	8	DEMONSTRATE ABILITY TO OPERATE VIDEO RECORDER IN PLAYBACK MODE	Given FOG-M video recorder, tape, and video display.	Operate all controls relevant to playback.	Operate the video recorder.	Procedures to operate video reocrder in playback mode.

NUMBER	L	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
11.01.02.01	6	STATE PROCEDURES TO OPERATE VIDEO RECORDER IN PLAYBACK MODE	Given video recorder/player.	State all relevant controls and their function.		Play, stop, freeze, fast forward, reverse, scan,
11.02	8	VIEW THE RECORDED SEEKER VIDEO AND ASSESS TARGET DAMAGE	Given the FOG-M ET system and a videotape of a reconnaissance missile recording of the subject missile impact.	Assess disability correctly 90% of the time.	Assess the probability that the missile disabled the target, operate video playback.	Characteristics of disabled target, procedures to use playback features.
11.02.01	8	STATE METHODS FOR ASSESSING TARGET DAMAGE	None	State methods correctly.		Real time video, recorded video, subject missile, and reconnaissance missile.
11.02.01.01	8	STATE EVIDENCE FOR TARGET DAMAGE	Given a particular damage assessment method.	State common elements of evidence indicating tank damage.		Common elements of evidence indicating tank damage.
11.02.02	8	REVIEW VIDEOTAPE OF THE TERMINAL PHASE AND IMPACT OF THE SUBJECT MISSILE	Given the FOG-M ET system and a video tape of subject missile impact.	Assess disability correctly 80% of the time.	Assess the probabiiity that the subject missile disabled the target, operate video playback.	Characteristics of target, procedures to use playback features.
12.	9	PERFORM A FULL FOG-M MISSION				

APPENDIX C

SUPPLEMENTAL COURSEWARE OUTLINE

Appendix C consists of only one lesson entitled, "Introduction and Demonstration." The lesson is broken into three steps:

1. What is FOG-M?

2. What is Embedded Training (ET)?

3. FOG-M Flight Demonstration

The format for this lesson follows the same structure as those lesson outlines found in Appendix A.

Lesson Number: Sup Lesson Title: Introduction and Demonstration

Topic: A. What is FOG-M?

Training time: 15 min Clas:U

Enabling Objective		Complete
01.	UNDERSTAND THE FOG-M SYSTEM	
01.01	STATE WHAT THE FOG-M SYSTEM IS	
01.02	STATE WHAT THE FOG-M SYSTEM DOES	

Lesson Number: Sup Lesson Title: Introduction and Demonstration

Topic: A. What is FOG-M?

Training time: 15 min Clas:U

Content	Notes
1. Frame sequence and narrative entitled: "What is the FOG-M system?" mentioning the following topics as an overview of FOG-M: a. FOG-M is an anti-tank missile. b. It is linked to a control mechanism via a fiber-optic link. c. It uses a mobile launcher. d. It can be controlled manually or automatically.	Pictures of the FOG-M system. Diagram of a firing.
2. Frame sequence and narrative explaining what the FOG-M system does: a. It flies to the target propelled by a rocket motor, at X speed. b. It flies using automatic guidance programmed into the computer, or by direct flight commands initiated by the gunner. c. Its range is X km. d. The gunner and the automated programming can use video sent back via the fiber-optic link. This video can represent the target on a CRT with the clarity of a black and white television picture. e. Manages from 1 to 3 missiles in a salvo.	
3. Frame sequence and narrative of the major subsystems of the FOG-M system: a. HMMWV b. Missile launcher c. Missiles d. Gunner's console e. VNAS	Line drawings of each subsystem device.

4. Frame sequence and narrative of the functional capabilities of the FOG-M system:
a. Definition of "functional capabilities."
b. System mobility.
c. Real-time control by gunner (human-in-the-loop control).
d. Control via planned mission, using visual correlator or standard flight parameters.
e. Missile range is greater than 5 km.
f. Target attack can come from any angle relative to the target, and various flight paths to the target area can be used.
g. Fiber-optic link is ECM resistant.
h. Reconnaissance capabilities.
i. Missiles can be fired in salvos of 3 missiles, with the lead missile providing guidance to the subsequent missiles.
j. The flight altitude envelope is X meters minimum altitude and Y meters maximum altitude.
k. The system can present a map display of the flight and target areas.
l. Embedded training to sustain gunner skills (OJT).
m. Simple user interface.
n. Automatic launch sequence.
o. Can follow a planned route and programmed altitude, including turns.

Lesson Number: Sup Lesson Title: Introduction and Demonstration

Topic: B. What is Embedded Training (ET)?

Training time: 10 min Clas:U

Enabling Objective		Complete
02.	UNDERSTAND EMBEDDED TRAINING (ET)	
02.00.01	UNDERSTAND THE CONTENTS OF LESSON 2	
02.01	DEFINE EMBEDDED TRAINING (ET)	
02.02	STATE THE BENEFITS OF EMBEDDED TRAINING (ET)	
02.03	UNDERSTAND HOW ET FITS INTO THE FOG-M SYSTEM	

Lesson Number: Sup Lesson Title: Introduction and Demonstration

Topic: B. What is Embedded Training (ET)?

Training time: 10 min Clas:U

Content	Notes

1. Lesson introduction frame -- topics to be covered.

2. Frame containing a definition of embedded training.
a. A training subsystem which is incorporated into the overall weapon or tactical system software and equipment configuration as a mode of operation.
b. May operate online (along with full system operation) or offline (in place of full system operation).
c. Provides training and assessment.
d. Uses the soldier/system interface.
e. Uses operational equipment and auxiliary equipment as necessary.
f. Provides training in the unit environment.
g. Develops or sustains operator and maintainer skill levels.
h. Could be used in the institutional environment.

3. Benefits of embedded training:
a. Cost.
b. Availability.
c. Fidelity.
d. Logistics.
e. Motivation.
f. May be included in full scale operational simulations using many people in varied jobs.
g. Distributed practice interspersed with other duties.
h. Immediate feedback of results.
i. Continuing field assessment.
j. May reduce need for expendables.

4. Frame sequence and narrative entitled: "How ET fits into the FOG-M system."
a. Trains procedures, skills, and knowledges.
b. Provides simulation using FOG-M video display and simulated FOG-M video.
c. Allows gunner control using actual system interface.
d. Allows free movement of seeker, along with zoom capability.
e. Allows directional and altitude control of missile by gunner.
f. Allows gunner to allow mission to impact.
g. Allows practice under conditions likely to be encountered in actual battle (terrain, smoke, fog, camouflage).
h. Requires no expenditure of missiles.
i. Allows OJT cross training.
j. Sustains gunner skills.

Lesson Number: Sup Lesson Title: Introduction and Demonstration

Topic: C. FOG-M Flight Demonstration

Training time: 30 min Clas:U

Enabling Objective	Complete
05.	PERFORM LAUNCH PROCEDURES
05.01	FIRE MISSILE
05.01.01	SELECT LAUNCH FUNCTION
06.	USE THE SEEKER
06.01	ADJUST SEEKER VIDEO
06.02.02	SLEW SEEKER TO CENTER THE TARGET AREA ON THE VIDEO DISPLAY
06.03	OPERATE SEEKER VIDEO
09.	DETECT/SELECT TARGETS
09.01	DETECT TARGETS
09.01.01	DISCRIMINATE TARGET AREA FROM BACKGROUND VIDEO
09.01.02	DETECT TARGETS THAT ARE CAMOUFLAGED
09.01.03	DETECT TARGETS IN VISUAL OBSCURATION (SMOKE, VEGETATION, AND FOG)
09.02	SELECT TARGETS
09.02.01	ZOOM IN ON TARGET
10.	GUIDE MISSILE DURING TERMINAL PHASE
10.01	LOCK MISSILE ON SELECTED TARGET
10.01.02	SLEW CROSS HAIRS ONTO TARGET AND MAINTAIN THEM ON TARGET
10.01.03	PERFORM AND VERIFY TARGET LOCK-ON
10.03	STEER MISSILE INTO TARGET MANUALLY

Lesson Number: Sup Lesson Title: Introduction and Demonstration

Topic: C. FOG-M Flight Demonstration

Training time: 30 min Clas:U

Content	Notes
1. Frame sequence and narrative explaining launch of missile. a. Gunner must tell the system where it is located (launcher data). b. Gunner must tell the system the location or direction in which it will fire the missile (guidance data). c. Gunner must tell the system how it will reach the target (guidance data). d. The missile can be launched once all the data have been checked and/or entered.	
2. Frame sequence and narrative explaining the launch procedures. a. Once the correlator selection has been made, the mission activation (launch) procedures begin. A PDP lights and flashes with the message "RDY TO LAUNCH", and a second PDP lights up and flashes with the message "ABORT MISSN". Press the "RDY TO LAUNCH" flashing PDP. b. Press the flashing "RDY TO LAUNCH" PDP to place the system in the pre-launch mode. The pre-launch mode is identified by the lighted PDP display as follows -- "LAUNCH CONTRL," PRE-LAUNCH," "ENABLE FIRE," and a fourth PDP, flashing, with the message "ABORT MISSN." The "ENABLE FIRE" PDP indicates that the missile and system are OK for firing to proceed.	Light up the appropriate PDPs. Put a message on the screen telling the gunner that the PDPs will be operated automatically. State which PDP is being enabled automatically by the system. Do not use flashing to highlight because the FOG-M system already uses flashing as a cue. Have the system run the launch procedure automatically until the final fire switch operation. Demonstrate a launch on coords.
c. The gunner activates the FIRE switch and the missile countdown begins. At the end of the countdown the missile fires automatically and the "MSL IN FLIGHT" PDP lights.	Show the actual sequence. Have the gunner use the correct switch.
3. Missile launches and pitches over.	Show the appropriate video on screen (clouds, then horizon).

4. Tell gunner how to switch to the map display.

5. Simulated FOG-M cruise. Gunner may use slew and zoom to view the scene. Missile continues to fly to target.

All flight parameters should be maintained automatically. Enable the map display if the switch is operated.

Present the following terrain features:

a. Mountains
b. Rivers
c. Roads
d. Buildings
e. Power lines
f. Railroads

The gunner should be able to repeat this item without going through other items.

Present the following targets:

a. Tanks deployed in the open
b. Tanks deployed in built-up areas
c. Tanks deployed in a lightly wooded area
d. Tanks deployed in rocky terrain
e. Track trail disappearing into broken vegetation
f. Tanks camouflaged with a combination of natural and artificial materials.
g. Tanks moving and stationary in smoke and/or dust.
h. Tanks moving and stationary in vegetation

6. Gunner can lock onto any target or object he selects during the cruise. If he does not choose to lock onto a probable target, the system does so at 60 seconds. The system should lock onto a moving tank in the open. When the system is about to do this it should query the gunner to see if it should. If the gunner does not want the system to lock automatically, it should continue the scenario for another 40 seconds. The gunner should be able to break lock and fly the missile manually after the missile pitches over and begins terminal mode.

APPENDIX D

OBJECTIVES HIERARCHY FOR THE HYPOTHESIZED FIELDED FOG-M SYSTEM

Appendix D is a compilation of all potential training objectives that are directed at a hypothesized fielded FOG-M system. Each hierarchy page contains the following information:

NUMBER - Objective number.

ET - Whether the objective is suitable for ET (Y = yes, N = no).

SKILL LEVEL - Skill level at which the objective should be taught:

I - Introductory (Training provided to the new trainee, whether in school or in the field).

S - Sustainment (Trains to the operational standard for the objective. These objectives are of moderate to high perishability or are specific to mission criticality).

E - Expert (Extends the capabilities of the human-machine system. This is done by: (1) training existing objectives to higher than operational standards, or (2) establishing and training new objectives that extend the capability of the human-machine system.)

TITLE - Objective title.

CONDITIONS - Conditions for performance.

STANDARDS - Standards of performance.

SKILLS - Skills required.

KNOWLEDGES - Knowledges to be gained.

NUMBER	ET	SKILL LEVEL	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
01.	N	I	KNOW THE BASIS OF OPERATION OF THE FOG-M SYSTEM				
01.01	N	I	STATE WHAT THE FOG-M SYSTEM IS	None.	Recognize the facts.		FOG-M is a fiberoptically controlled, video guided, mobile missile system.
01.02	N	I	STATE WHAT THE FOG-M SYSTEM DOES	None.	Recognize the facts.		FOG-M system fires single missiles or salvos at hardpoint targets such as tanks. Missiles can be automatically or manually guided. Phases of missile flight.
01.03	N	I,S	STATE THE CAPABILITIES OF THE FOG-M SYSTEM	None.	State the capabilities.		Land nav via VNAS, FOG-M flight planning & waypoints, auto launch sequence, multi-launch, correlator, auto track, map, MAN control, video record/play, seeker scan, attitude stabilization, alt. control, BITE, recon., user interface.
01.03.01	N	I,S	STATE FUNCTIONAL CAPABILITIES OF THE FOG-M SYSTEM	None.	State the capabilities.		Automatic land nav., flight planning and waypoints, auto launch sequence, multiple launch, pattern recognition, map, manual control, simple user interface, video view, recon capability, video record/play.

NUMBER	ET	SKILL LEVEL	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
01.03.02	N	I,S	STATE THE EQUIPMENT CAPABILITIES OF THE FOG-M SYSTEM	None.	State the capabilities.		Land nav via VNAS, video recorder, autotrack, map display, seeker slew, independent altitude control, seeker independent or slaved to seeker, correlator, salvo, BITE, launcher based computer, fiberoptic link.
01.04	N	I,S	STATE THE MAJOR SUBSYSTEMS OF THE FOG-M SYSTEM	None.	Recognize the subsystems.		HMMWV. missile launcher, missiles, gunner's console.
01.05	N	I,S	NAME EACH CONTROL AND DISPLAY ON THE FOG-M SYSTEM CONSOLE AND STATE ITS FUNCTION	Given the FOG-M system console.	State correctly 90% of the items.		
01.05.01	N	I,S	NAME EACH CONTROL AND DISPLAY ON THE FOG-M SYSTEM CONSOLE	Given the FOG-M system console.	Name 90% of the items correctly. Descriptive names are acceptable.		Names of all items.
01.05.02	N	I,S	STATE THE FUNCTION OF EACH CONTROL AND DISPLAY ON THE FOG-M SYSTEM CONSOLE	Given the FOG-M system console.	State the functions correctly for 90% of the items.		Functions of all equipment. Knowledge of the general operation of FOG-M.
01.05.03	N	I,S	UNDERSTAND THE OPERATION OF THE PDP'S AND THE ADVANCE SUBFUNCTION KEY	Given the FOG-M system and an appropriate point in the misaile launch sequence.	Respond to prompts correctly.		How the PDP's light up and what flashing lights mean.

NUMBER	ET	SKILL LEVEL	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
01.06	N	I,S,E	STATE THE GUNNER SKILLS TO BE TRAINED FOR THE FOG-M SYSTEM	None.	State the skills to be trained.		Tracking, target recognition/discrimination/ prioritization, map reading, map symbology related to video, simple procedures, missile control, mission/route planning, land nav., system deployment.
01.06.01	N	I,S	STATE THE FUNCTIONS REQUIRED TO OPERATE THE FOG-M SYSTEM	Given a choice of possible functions.	Recognize the functions at a 90% level of accuracy.		Phases of flight, target detection, contingencies, impact assessment.
02.	N	I,S	PREPARE THE FOG-M SYSTEM FOR A MISSION	Given the FOG-M system and HMMWV.	Perform completely and correctly.		Procedure to prepare FOG-M system for a mission.
02.01	N		HMMWV PRE-OPERATION INSPECTION/CHECK	Given the HMMWV.	Complete the inspection and recognize and correct all errors.		Procedures to run pre-op inspection and check.
02.01.01	N		HMMWV SIGN-OUT	Given all forms.	Complete correctly.		
02.01.01.01	N		OBTAIN TRIP TICKET & CHECK LIST	Given all forms.	Complete correctly.	Review HMMWV maintenance log for outstanding discrepancies.	Procedure for dispatching HMMWV.
02.01.01.02	N		OBTAIN HMMWV TOOL KIT & OTHER EQUIPMENT	Given the HMMWV with FOG-M.	Know the requirement and perform correctly.	Load field maintenance equipment.	Procedure for stowing field maintenance equipment.
02.01.02	N		INSPECT HMMWV EXTERIOR	Given the HMMWV.	Perform completely and correctly.		

NUMBER	ET SKILL LEVEL	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
02.01.02.01	N	INSPECT TIRES (INCLUDING SPARE)	Given the HMMWV.	Perform correctly.	Review HMMWV maintenance log for outstanding discrepancies perform a visual walk around inspection of the HMMWV.	Procedures for verifying HMMWV status using maintenance records normal HMMWV equipment parameters (i.e., battery levels, etc.).
02.01.02.02	N	INSPECT LAMP LENSES	Given the HMMWV.	Perform correctly.	Review HMMWV maintenance log for outstanding discrepancies perform a visual walk around inspection of the HMMWV.	Procedures for verifying HMMWV status using maintenance records normal HMMWV equipment parameters (i.e., battery levels, etc.).
02.01.02.03	N	INSPECT WINDOWS/WIPERS	Given the HMMWV.	Perform correctly.	Review HMMWV maintenance log for outstanding discrepancies perform a visual walk around inspection of the HMMWV.	Procedures for verifying HMMWV status using maintenance records normal HMMWV equipment parameters (i.e., battery levels, etc.).
02.01.02.04	N	INSPECT BATTERY BOX & BATTERIES	Given the HMMWV.	Perform correctly.	Review HMMWV maintenance log for outstanding discrepancies verify normal operating parameters of all HMMWV systems verify charge level of batteries.	Procedures for verifying HMMWV status using maintenance records normal HMMWV equipment parameters (i.e., battery levels, etc.) procedures for degraded capabilities.
02.01.02.05	N	INSPECT HMMWV UNDERCARRIAGE FOR LEAKS, LOOSE WIRES, ETC.	Given the HMMWV.	Perform correctly.	Review HMMWV maintenance log for outstanding discrepancies perform a visual walk around inspection of the HMMWV.	Procedures for verifying HMMWV status using maintenance records normal HMMWV equipment parameters (i.e., battery levels, etc.).

NUMBER	ET SKILL LEVEL	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
02.01.03	N	INSPECT INTERIOR CAB AREA	Given the HMMWV.	Perform correctly.		
02.01.03.01	N	INSPECT SEATS	Given the HMMWV.	Perform correctly.	Review HMMWV maintenance log for outstanding discrepancies perform a visual of HMMWV fluid levels.	Procedures for verifying HMMWV status using maintenance records normal HMMWV equipment parameters (i.e., battery levels, etc.).
02.01.04	N	INSPECT ENGINE COMPARTMENT AREA	Given the HMMWV.	Perform correctly.		
02.01.04.01	N	CHECK ENGINE OIL	Given the HMMWV.	Perform correctly.	Review HMMWV maintenance log for outstanding discrepancies perform inspection of HMMWV fluid levels.	Procedures for verifying HMMWV status using maintenance records normal HMMWV equipment parameters (i.e., battery levels, etc.).
02.01.04.02	N	CHECK ENGINE COOLANT	Given the HMMWV.	Perform correctly.	Review HMMWV maintenance log for outstanding discrepancies perform inspection of HMMWV fluid levels.	Procedures for verifying HMMWV status using maintenance records normal HMMWV equipment parameters (i.e., battery levels, etc.).
02.01.04.03	N	CHECK BRAKE FLUID	Given the HMMWV.	Perform correctly.	Review HMMWV maintenance log for outstanding discrepancies perform inspection of HMMWV fluid levels.	Procedures for verifying HMMWV status using maintenance records normal HMMWV equipment parameters (i.e., battery levels, etc.).
02.01.04.04	N	CHECK TRANSMISSION FLUID (IF APPLICABLE)	Given the HMMWV.	Perform correctly.	Review HMMWV maintenance log for outstanding discrepancies perform inspection of HMMWV fluid levels.	Procedures for verifying HMMWV status using maintenance records normal HMMWV equipment parameters (i.e., battery levels, etc.).

NUMBER	ET SKILL LEVEL	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
02.01.04.05	N	CHECK HYDRAULIC FLUID	Given the HMMWV.	Perform correctly.	Review HMMWV maintenance log for outstanding discrepancies perform inspection of HMMWV fluid levels.	Procedures for verifying HMMWV status using maintenance records normal HMMWV equipment parameters (i.e., battery levels, etc.) procedures for degraded capabilities.
02.01.04.06	N	CHECK TRANSFER CASE/DIFFERENTIAL	Given the HMMWV.	Perform correctly.	Review HMMWV maintenance log for outstanding discrepancies perform inspection of HMMWV fluid levels.	Procedures for verifying HMMWV status using maintenance records normal HMMWV equipment parameters (i.e., battery levels, etc.).
02.01.04.07	N	CHECK HOSES/BELTS	Given the HMMWV.	Perform correctly.	Review HMMWV maintenance log for outstanding discrepancies verify normal operating parameters of all HMMWV systems.	Procedures for verifying HMMWV status using maintenance records normal HMMWV equipment parameters (i.e., battery levels, etc.).
02.01.04.08	N	CHECK WIRES/CONNECTIONS	Given the HMMWV.	Perform correctly.	Review HMMWV maintenance log for outstanding discrepancies verify normal operating parameters of all HMMWV systems.	Procedures for verifying HMMWV status using maintenance records normal HMMWV equipment parameters (i.e., battery levels, etc.).
02.01.05	N	HMMWV POWER-UP/TEST	Given the HMMWV.	Perform correctly.		
02.01.05.01	N	OBSERVE ALL GAUGE INDICATIONS	Given the HMMWV.	Perform correctly.	Review HMMWV maintenance log for outstanding discrepancies start vehicle engine verify normal operating parameters of all HMMWV systems verify charge level of batteries.	Procedures for verifying HMMWV status using maintenance records normal HMMWV equipment parameters (i.e., battery levels, etc.) procedures for degraded capabilities.

NUMBER	ET SKILL LEVEL	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
02.01.05.02	N	TEST BRAKES	Given the HMMWV.	Perform correctly.	Review HMMWV maintenance log for outstanding discrepancies start vehicle engine verify normal operating parameters of all HMMWV systems.	Procedures for verifying HMMWV status using maintenance records normal HMMWV equipment parameters (i.e., battery levels, etc.) procedures for degraded capabilities.
02.01.05.03	N	TEST LIGHTS (ROAD/TACTICAL)	Given the HMMWV.	Perform correctly.	Reveiw HMMWV maintenance log for outstanding discrepancies start vehicle engine verify normal operating parameters of all HMMWV systems.	Procedures for verifying HMMWV status using maintenance records normal HMMWV equipment parameters (i.e., battery levels, etc.) procedures for degraded capabilities.
02.02	N	HMMWV MAINTANANCE/PM'S	Given the HMMWV.	Perform correctly.		
02.02.01	N	PERFORM TIRE MAINTENANCE	Given the HMMWV.	Perform correctly.		
02.02.01.01	N	INFLATE OR DEFLATE TIRES	Given the HMMWV.	Perform correctly.	Perform PM on HMMWV troubleshoot and correct minor HMMWV discrepancies.	Organizational level maintenance procedures, including PM procedures for using basic handtools, test equipment general specifications for HMMWV.
02.02.01.02	N	CHANGE TIRE	Given the HMMWV.	Perform correctly.	Perform PM on HMMWV troubleshoot and correct minor HMMWV discrepancies.	Organizational level maintenance procedures, including PM procedures for using basic handtools, test equipment.

NUMBER	ET SKILL LEVEL	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
02.02.02	N	PERFORM HMMWV LAMP MAINTENANCE	Given the HMMWV.	Perform correctly.		
02.02.02.01	N	REPLACE UNSERVICEABLE LAMPS	Given the HMMWV.	Perform correctly.	Perform PM on HMMWV troubleshoot and correct minor HMMWV discrepancies.	Organizational level maintenance procedures, including PM procedures for using basi mechanical troubleshooting procedures for using basi handtools, test equipment.
02.02.03	N	PERFORM WINDOW/WIPER MAINTENANCE	Given the HMMWV.	Perform correctly.		
02.02.03.01	N	RELACE WORN OR MISSING WIPER BLADES	Given the HMMWV.	Perform correctly.	Perform PM on HMMWV.	Organizational level maintenance procedures, including PM procedures for using basi handtools, test equipment general specifications fo HMMWV.
02.02.03.02	N	ROUTE HMMWV TO HIGHER-LEVEL MAINTENANCE FOR WINDOW REPLACEMENT	Given the proper forms.	Complete correctly.	Complete required forms to route HMMWV to higher echelon maintenance.	Organizational level maintenance procedures, including PM mechanical characteristi of HMMWV procedures for basic mechanical troubleshootin
02.02.04	N	PERFORM BATTERY MAINTENANCE	Given the HMMWV.	Complete correctly.		
02.02.04.01	N	CHECK BATTERY CELL FLUID LEVELS & REFILL AS NEEDED	Given the HMMWV.	Complete correctly.	Perform PM on HMMWV adjust (fill/drain) HMMWV fluid, lubricant levels.	Organizational level maintenance procedures, including PM procedures for using basi handtools, test equipment general specifications fo HMMWV.

NUMBER	ET SKILL LEVEL	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
02.02.04.02	N	CHECK BATTERY CHARGE & OUTPUT LEVEL	Given the HMMWV.	Complete correctly.	Perform PM on HMMWV.	Organizational level maintenance procedures, including PM mechanical characteristics of HMMWV procedures for using basic mechanical troubleshooting procedures for using basic handtools, test equipment general specifications for HMMW.
02.02.04.03	N	REPLACE UNSERVICEABLE BATTERIES	Given the HMMWV.	Complete correctly.	Perform PM on HMMWV troubleshoot and correct minor HMMWV discrepancies.	Organizational level maintenance procedures, including PM procedures for using basic handtools, test equipment general specifications for HMMWV.
02.02.04.04	N	CHARGE BATTERIES	Given the HMMWV.	Complete correctly.	Prepare HMMWV batteries for charging connect and energize battery charger remove and replace HMMWV batteries.	Procedures for charging batteries procedures for removing and replacing HMMWV batteries.
02.02.05	N	RESTORE HMMWV FLUID/LUBRICANT LEVELS	Given the HMMWV.	Complete correctly.		
02.02.05.01	N	REFILL OR DRAIN ENGINE OIL TO PROPER LEVEL	Given the HMMWV.	Complete correctly.	Perform PM on HMMWV adjust (fill/drain) HMMWV fluid, lubricant levels.	Organizational level maintenance procedures, including PM procedures for using basic handtools, test equipment general specifications for HMMWV.

NUMBER	ET SKILL LEVEL	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
02.02.05.02	N	REFILL OR DRAIN COOLANT TO PROPER LEVEL	Given the HMMWV.	Complete correctly.	Perform PM on HMMWV adjust (fill/drain) HMMVW fluid, lubricant levels.	Organizational level maintenance procedures, including PM procedures for using basic handtools, test equipment general specifications for HMMWV.
02.02.05.03	N	REFILL BRAKE FLUID RESERVOIR TO PROPER LEVEL	Given the HMMWV.	Complete correctly.	Perform PM on HMMWV adjust (fill/drain) HMMWV fluid, lubricant levels.	Organizational level maintenance procedures, including PM procedures for using basic handtools, test equipment general specifications for HMMWV.
02.02.05.04	N	REFILL OR DRAIN TRANSMISSION FLUID TO PROPER LEVEL	Given the HMMWV.	Complete correctly.	Perform PM on HMMWV adjust (fill/drain) HMMWV fluid, lubricant levels.	Organizational level maintenance procedures, including PM procedures for using basic handtools, test equipment general specifications for HMMWV.
02.02.05.05	N	REFILL OR DRAIN HYDRAULIC FLUID TO PROPER LEVEL	Given the HMMWV.	Complete correctly.	Perform PM on HMMWV adjust (fill/drain) HMMWV fluid, lubricant levels.	Organizational level maintenance procedures, including PM procedures for using basic handtools, test equipment general specifications for HMMWV.
02.02.05.06	N	REFILL OR DRAIN TRANSFER CASE/DIFFERENTIAL FLUID TO PROPER LEVEL	Given the HMMWV.	Complete correctly.	Perform PM on HMMWV adjust (fill/drain) HMMWV fluid, lubricant levels.	Organizational level maintenance procedures, including PM procedures for using basic handtools, test equipment general specifications for HMMWV.

NUMBER	ET	SKILL LEVEL	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
02.02.06	N		REPLACE UNSERVICEABLE HOSES/BELTS	Given the HMMWV.	Recognize and replace correctly.		
02.02.06.01	N		ROUTE HMMWV TO HIGHER-LEVEL MAINTENANCE FOR HOSE OR DRIVE-BELT REPLACEMENT	Given the HMMWV.	Recognize situations where this is appropriate and complete correctly.	Perform PM on HMMWV complete required forms to route HMMWV to higher echelon maintenance.	Organizational level maintenance procedures, including PM mechanical characteristics of HMMWV procedures for basic mechanical troubleshooting general specifications for HMMWV.
02.02.07	N		REPLACE UNSERVICEABLE WIRES	Given the HMMWV.	Recognize and replace correctly.		
02.02.07.01	N		ROUTE HMMWV TO HIGHER-LEVEL MAINTENANCE FOR WIRE REPLACEMENT	Given the HMMWV.	Recognize appropriate situations for maintenance routing.	Perform PM on HMMWV complete required forms to route HMMWV to higher echelon maintenance.	Organizational level maintenance procedures, including PM mechanical characteristics of HMMWV procedures for basic mechanical troubleshooting procedures for using basic handtools, test eqmt general specifications for HMMWV.
02.03	N	I	LOAD MISSILES ONTO HMMWV	Given the HMMWV and FOG-M system, and appropriate checklists and manuals.	Perform correctly.		
02.03.01	N	I	ATTACH MISSILE LAUNCHER TO HMMWV	Given the FOG-M system and HMMWV and appropriate checklists and manuals.	Perform correctly.		

NUMBER	ET	SKILL LEVEL	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
02.03.01.01	N	I	ATTACH LAUNCHER GROUNDING WIRE TO HMMWV	Given the HMMWV and FOG-M system and appropriate checklists and manuals.	Perform correctly.	Position HMMWV to receive launcher attach grounding cables to launcher and HMMWV ability to recognize poor grounding.	Procedures for safe ordnance handling procedure for configuring HMMWV for receiving FOG-M launcher procedure for loading launcher procedure for connecting launcher to HMMWV procedure to inspect ground.
02.03.01.01.01	N	I,S	THE LAUNCHER CANNOT BE GROUNDED	Given the HMMWV and FOG-M system and appropriate checklists and manuals.	Recognize the failure situation correctly 100% of the time.		Proper inspection procedure to determine adequacy of grounding.
02.03.01.01.02	N	I	REPLACE GROUNDING CABLE	Given the HMMWV and FOG-M system and appropriate checklists and manuals.	Perform correctly.	Inspect grounding cable assembly and determine failed part remove/replace defective part.	Characteristics of a normally configured grounding cable assembly procedures for removing/replacing failed parts.
02.03.01.02	N	I	DEPLOY HMMWV STABILIZER PADS	Given the HMMWV and FOG-M system and appropriate checklists and manuals.	Perform correctly.	Position HMMWV to receive launcher attach grounding cables to launcher and HMMWV.	SOP for loading FOG-M launcher procedure for configuring HMMWV for receiving FOG-M launcher procedure for loading launcher.
02.03.01.02.01	N	I	HMMWV STABILIZER PADS DO NOT DEPLOY	Given the HMMWV and FOG-M system and appropriate checklists and manuals.	Recognize situation correctly 100% of the time.		Proper deployed appearance of stabilizer pads.

NUMBER	ET	SKILL LEVEL	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
02.03.01.02.02	N	I	CHECK FOR MECHANICAL BINDING	Given the HMMWV and FOG-M system and appropriate checklists and manuals.	Recognize failure situation correctly 100% of the time.	Visually inspect launcher stablizer pads for evidence of obstructions or lack of lubrication.	Inspection procedure characteristics of normally operating launche stablizer pads.
02.03.01.02.03	N	I	CHECK HYDRAULICS TO PADS	Given the HMMWV and FOG-M system and appropriate checklists and manuals.	Perform correctly.	Visually inspect launcher stabilizer pad hydraulic actuators, lines and gauge fittings for proper pressure check hydraulic gauges for proper pressure check hydraulic reservoir levels.	Procedure for visually inspecting the launcher hydraulic system characteristics of a normally operating launche hydrsulic system.
02.03.01.02.04	N	I	CHECK ELECTRICAL SUPPLY TO PADS	Given the HMMWV and FOG-M system and appropriate checklists and manuals.	Perform correctly.	Verify that electrical power is available to actuators procedure for checking whether power is available to actuators.	Procedure for checking whether power is available to the actuators.
02.03.01.03	N	I	EXTEND HYDRAULIC ARMS TO ENGAGE LAUNCHER SECURING POINTS	Given HMMWV and FOG-M system and appropriate checklists and manuals.	Perform correctly.	Position HMMWV to receive launcher attach grounding cables to launcher and HMMWV.	Procedure for configuring HMMWV for receiving FOG-M launcher procedure for connecting launcher to HMMWV characteristics of normal stowed FOG-M launcher.
02.03.01.03.01	N	I	DETERMINE WHY ONE OR BOTH LAUNCHER ATTACHING ARMS WILL NOT EXTEND	Given the HMMWV and FOG-M system and appropriate checklists and manuals.	Determine the problem situation correctly 90% of the time.		

NUMBER	ET	SKILL LEVEL	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
02.03.01.03.01.01	N	I	CHECK FOR MECHANICAL BINDING	Given the HMMWV and FOG-M system and appropriate checklists and manuals.	Perform correctly.	Visually inspect launcher attaching arms for evidence of obstructions or lack of lubrication.	Inspection procedure characteristics of normally operating launcher attaching arms.
02.03.01.03.01.02	N	I	CHECK HYDRAULICS	Given the HMMWV and FOG-M system and appropriate checklists and manuals.	Perform correctly.	Visually inspect attaching arm hydraulic actuators, lines, and gauge fittings for leakage check hydraulic gauges for proper pressure check hydraulic reservoir level.	Procedure for visually inspecting the launcher hydraulic system characteristics of a normally operating attaching arm hydraulic system.
02.03.01.03.01.03	N	I	CHECK ELECTRICAL SUPPLY TO LAUNCHER ATTACHING ARMS	Given the HMMWV and FOG-M system and appropriate checklists and manuals.	Perform correctly.	Verify that electrical power is available to actuators.	Procedure for checking whether power is available to actuators.
02.03.01.04	N	I	ATTACH AND LOCK LAUNCHER TO HYDRAULIC ARMS	Given the HMMWV and FOG-M system and appropriate checklists and manuals.	Perform correctly 100% of the time.	Position HMMWV to receive launcher attach grounding cables to launcher and HMMWV.	Procedures for safe ordnance handling procedure for connecting launcher to HMMWV characteristics of normal stowed FOG-M launcher.
02.03.01.04.01	N	I	RECOGNIZE THAT LAUNCHER ATTACHING ARMS CANNOT BE ATTACHED	Given the HMMWV and FOG-M system and appropriate checklists and manuals.	Recognize correctly 100% of the time.		Procedure to attach and inspect launcher arms.
02.03.01.04.01.01	N	I	CHECK ATTACHING POINTS ON THE ARMS AND THE LAUNCHER	Given the HMMWV and FOG-M system and appropriate checklists and manuals.	Perform correctly.	Visually inspect attaching points on attaching arms and launcher.	Inspection procedure characteristics of normally operating attaching arms.

NUMBER	ET	SKILL LEVEL	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
02.03.02	N	I	LOAD LAUNCHER INTO HMMWV LAUNCHER STOWAGE COMPARTMENT	Given the HMMWV and FOG-M system and appropriate checklists and manuals.	Perform all steps and correct all errors prior to completion.		
02.03.02.01	N	I	RETRACT HYDRAULIC ARMS AND GUIDE LAUNCHER INTO COMPARTMENT	Given the HMMWV and FOG-M system and appropriate checklists and manuals.	Perform correctly.	Stow launcher on HMMWV.	Procedure for loading launcher characteristics of normal stowed FOG-M launcher.
02.03.02.01.01	N	I	RECOGNIZE THAT LAUNCHER ATTACHING ARMS WILL NOT RETRACT EVENLY	Given the HMMWV and FOG-M system and appropriate checklists and manuals.	Recognize situation 100% of the time.		
02.03.02.01.01.01	N	I	CHECK FOR MECHANICAL BINDING	Given the HMMWV and FOG-M system and appropriate checklists and manuals.	Perform correctly.	Visually inspect launcher attaching arms for evidence of obstructions or lack of lubrication.	Inspection procedure characteristics of normally operating attaching arms.
02.03.02.01.01.02	N	I	CHECK HYDRAULICS	Given the HMMWV and FOG-M system and appropriate checklists and manuals.	Perform correctly.	Visually inspect attaching arms hydraulic actuators, lines, and gauge fittings for leakage check hydraulic gauges for proper pressure check hydraulic reservoir level.	Inspection procedure characteristics of a normally operating attaching arm hydraulic system.
02.03.02.01.01.03	N	I	CHECK ELECTRICAL SUPPLY TO ATTACHING ARMS	Given th HMMWV and FOG-M system and appropriate checklists and manuals.	Perform correctly.	Verify that electrical power is available to actuators.	Procedure for checking whether power is available to the actuator.
02.03.02.01.01.04	N	I,S	CHECK LAUNCHER/HMMWV ATTITUDE	Given the HMMWV and FOG-M system and appropriate checklists and manuals.	Perform correctly within +/- X degrees.	Verify that launcher and HMMWV arm configured to one another properly, and both are as level as possible.	Procedure for checking launcher/HMMWV attitude procedure for correcting launcher/HMMWV attitude.

NUMBER	ET	SKILL LEVEL	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
02.03.02.01.01.05	N	I,S	ADJUST LAUNCHER/HMMWV ATTITUDE	Given the HMMWV and FOG-M system and appropriate checklists and manuals.	Adjust to within +/- X degrees within Y minutes.		
02.03.02.01.01.06	N	I	CHECK FOR LAUNCH SITE OBSTRUCTIONS.	Given appropriate launch site terrain.	Detect all obstructions.	Visually inspect terrain at launch site.	Characteristics of a suitable launch site.
02.03.02.02	N	I	INSPECT LAUNCHER WIRING HARNESS CONNECTOR	Given the HMMWV and FOG-M system and appropriate checklists and manuals.	Perform correctly.	Perform visual inspection of launcher and missile cells.	Characteristics of normal stowed FOG-M launcher.
02.03.02.03	N	I	CONNECT LAUNCHER WIRING HARNESS CONNECTOR TO THE LAUNCHER WIRING RECEPTACLE	Given the FOG-M system and appropriate checklists and manuals.	Perform correctly.	Connect launcher wiring harness to HMMWV.	SOP for loading FOG-M launcher characteristics of normal stowed FOG-M launcher.
02.03.02.04	N	I	LOCK LAUNCHER IN PLACE	Given the HMMWV and FOG-M system and appropriate checklists and manuals.	Perform correctly.	Latch and lock launcher into place on HMMWV load launcher into HMMWV.	SOP for loading FOG-M lanucher procedure for loading launcher.
02.03.02.04.01	N	I	DETERMINE THAT THE LAUNCHER POD CANNOT BE LOCKED INTO THE HMMWV COMPARTMENT	Given the HMMWV and FOG-M system and appropriate checklists and manuals.	Detect correctly 100% of the time.		
02.03.02.04.01.01	N	I	CHECK LATCHING LOCK MECHANISM	Given the HMMWV and FOG-M system and appropriate checklists and manuals.	Perform correctly.	Verify latching lock mechanism has no broken/bent/worn components.	Procedure for checking latching lock mechanism.
02.03.02.04.01.02	N	I	CHECK THAT THE LAUNCHER POD IS PROPERLY LOADED	Given the HMMWV and FOG-M system and appropriate checklists and manuals.	Perform correctly 100% of the time.	Verify launcher pod is properly seated within the HMMWV compartment.	Procedure for loading the launcher pod into the HMMWV.

NUMBER	ET	SKILL LEVEL	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
02.03.02.04.01.03	N	I	WRITE UP FOR MAINTENANCE	Given the appropriate forms and checklists.	Perform completely and correctly.	Log all malfunctions with description of malfunctions and any other relevant information.	Standard operating procedure for documenting failed equipment for repair.
02.03.02.05	N	I	RETRACT AND SECURE STABILIZER PADS TO HMMWV	Given the HMMWV and FOG-M system and appropriate checklists and manuals.	Perform correctly within X minutes.	Configure HMMWV for movement.	SOP for loading FOG-M launcher procedure for loading launcher.
02.03.02.05.01	N	I	RECOGNIZE THAT STABILIZER PADS DO NOT RETRACT	Given the HMMWV and FOG-M system and appropriate checklists and manuals.	Recognize correctly 100% of the time.		
02.03.02.05.01.01	N	I	CHECK FOR MECHANICAL BINDING	Given the HMMWV and FOG-M system and appropriate checklists and manuals.	Perform correctly.	Visually inspect launcher stablizer pads for evidence of obstructions or lack of lubrication.	Inspection procedure characteristics of a normally operating launcher stablizer pad.
02.03.02.05.01.02	N	I	CHECK HYDRAULICS	Given the HMMWV and FOG-M system and appropriate checklists and manuals.	Perform correctly.	Visually inspect launcher stabilizer pads, hydraulic actuators, lines, and gauge fittings for leakage check hydraulic gauges for proper pressure check hydraulic reservoir level.	Procedure for visually inspecting the launcher hydraulic system characteristics of a normally operating launcher hydraulic system.
02.03.02.05.01.03	N	I	CHECK ELECTRICAL SUPPLY TO PADS	Given the HMMWV and FOG-M system and appropriate checklists and manuals.	Perform correctly.	Verify that electrical power is available to actuators.	Procedure for checking whether power is available to the actuators.
02.03.02.05.01.04	N	I	DETACH/ABANDON/DESTRUCT LAUNCHER	Given the HMMWV and FOG-M system and appropriate checklists and manuals.	State correct procedures.	Detach non-retractable launcher from HMMWV and destroy in place.	Procedure for detaching launcher from HMMWV standard operating procedure for destroying disabled or faulty launcher.

NUMBER	ET	SKILL LEVEL	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
02.04	N	I,S	PERFORM LAUNCHER/MISSILE PRE-OPERATION INSPECTION/CHECK	Given the HMMWV and FOG-M system and appropriate checklists and manuals.	Correct all errors prior to completion. Complete within X minutes.		
02.04.01	N	I	INSPECT LAUNCHER GROUNDING WIRE	Given the HMMWV and FOG-M system and appropriate checklists and manuals.	Perform correctly.		
02.04.01.01	N	I	ENSURE THAT LAUNCHER GROUNDING WIRE IS SECURELY ATTACHED AT BOTH LAUNCHER AND HMMWV	Given the HMMWV and FOG-M system and appropriate checklists and manuals.	Perform correctly.	Secure launcher grounding wire.	Procedure for attaching launcher grounding wire.
02.04.02	N	I	INSPECT LAUNCHER WIRING HARNESS AND ITS CONNECTOR PLUGS	Given the HMMWV and FOG-M system and appropriate checklists and manuals.	Perform correctly.		
02.04.02.01	N	I	ENSURE THAT LAUNCHER WIRING HARNESS CONNECTORS ARE DIRT- AND MOISTURE-FREE	Given the HMMWV and FOG-M system and appropriate checklists and manuals.	Perform correctly.	Inspect wiring harness connectors.	Procedure for inspecting connectors.
02.04.03	N	I	INSPECT THE LAUNCHER WIRING HARNESS CONNECTION AT THE HMMWV RECEPTACLE	Given the HMMWV and FOG-M system and appropriate checklists and manuals.	Perform correctly.		
02.04.03.01	N	I	ENSURE THAT THE LAUNCHER WIRING HARNESS IS SECURELY PLUGGED INTO THE HMMWV	Given the HMMWV and FOG-M system and appropriate checklists and manuals.	Perform correctly.	Inspect launcher/HMMWV connections at the HMMWV.	Characteristics of secure connections.

NUMBER	ET	SKILL LEVEL	TITLE	CONDITIONS	STANDARDS	SKILLS	*KNOWLEDGES*
02.05	N		MAINTAIN THE LAUNCHER/MISSILE (TBD)				
02.06	N	I,S	PERFORM FOG-M SYSTEM PRE-OPERATION INSPECTION\CHECK	Given the HMMWV and FOG-M system and appropriate checklists and manuals.	Correct all errors prior to completion and complete within K minutes.		
02.06.01	N	I	INSPECT/CHECK GUNNER'S CONSOLE HMMWV INSTALLATION	Given the HMMWV and FOG-M system and appropriate checklists and manuals.	Correct all errors prior to completion and complete within X minutes.		
02.06.01.01	N	I	REMOVE GUNNER'S CONSOLE FROM HMMWV MOUNT	Given the HMMWV and FOG-M system and appropriate checklists and manuals.	Perform correctly.	Unfasten and remove gunner's console from HMMWV mount.	Procedure for removing/replacing gunner's console.
02.06.01.02	N	I	INSPECT GUNNER'S CONSOLE POWER RECEPTACLE AND WIRING HARNESS	Given the HMMWV and FOG-M system and appropriate checklists and manuals.	Perform correctly.	Connect console power receptacle.	Procedure for connecting console power receptacle.
02.06.01.03	N	I	INSPECT GUNNER'S CONSOLE SECURING HARDWARE	Given the HMMWV and FOG-M system and appropriate checklists and manuals.	Perform correctly.	Inspect GS mounting rack.	Procedure for inspecting GS mounting rack.
02.06.01.04	N	I	REINSTALL GUNNER'S CONSOLE AND SECURE	Given the HMMWV and FOG-M system and appropriate checklists and manuals.	Perform correctly.	Install GS into HMMWV mount.	Procedure for removing/replacing GS.
02.06.02	N	I	INSPECT/CHECK FOG-M SYSTEM MODULE STOWAGE COMPARTMENTS	Given the HMMWV and FOG-M system and appropriate checklists and manuals.	Perform correctly.		

NUMBER	ET	SKILL LEVEL	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
02.06.02.01	N	I	INSPECT EACH FOG-M SYSTEM MODULE, ITS WIRING HARNESS, SECURITY OF STORAGE, PROTECTIVE DUST COVERS	Given the HMMWV and FOG-M system and appropriate checklists and manuals.	Perform correctly.	Visually inspect FOG-M system GS and peripheral equipment.	Indications of FOG-M system module(s) normal installation procedure for inspecting modules.
02.06.02.02	N	I	INSPECT LAUNCHER POWER RECEPTACLE AND PROTECTIVE COVER	Given the HMMWV and FOG-M system and appropriate checklists and manuals.	Perform correctly.	Visually inspect launch connectors.	Indications of normal power receptical configuration.
02.06.02.03	N	I	INSPECT EXTERNAL POWER RECEPTACLE AND PROTECTIVE COVER	Given the HMMWV and FOG-M system and appropriate checklists and manuals.	Perform correctly.	Inspect external DC power receptacle/cover.	Procedure for inspecting external DC power receptacle/cover.
02.06.02.04	N	I	INSPECT LAUNCHER GROUNDING WIRE RECEPTACLE AND PROTECTIVE COVER	Given the HMMWV and FOG-M system and appropriate checklists and manuals.	Perform correctly.	Inspect grounding wire receptacle/cover.	Procedure for inspecting grounding wire receptacle/cover.
02.07	N	I,S,E	MAINTAIN THE FOG-M SYSTEM (TBD)				
02.08	N	I	PERFORM COMMUNICATIONS PRE-OPERATION INSPECTION\CHECK	Given FOG-M system, appropriate radio, checklists, and manuals.	Perform all procedures correctly.		COMM procedures.
02.08.01	N	I	PERFORM RADIO OPERATIONAL CHECK	Given appropriate radio, checklists, and manuals.	Perform correctly.		COMM procedures.
02.08.01.01	N	I	SET RADIO TO DESIGNATED TACTICAL FREQUENCY	Given radio.	Perform correctly.	Select prebriefed frequency into radio.	Procedure for selecting radio frequency procedure to test both primary and alternate frequency.

NUMBER	ET	SKILL LEVEL	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
02.08.01.02	N	I	PERFORM RADIO VOICE CHECK	Given radio.	Perform correctly, using correct terminology and procedures.	Perform communications check on primary frequency.	Procedure for performing communications check.
02.08.02	N	I	REPAIR/REPLACE NON-FUNCTIONAL RADIO EQUIPMENT	Given FOG-M system, appropriate radio, checklists, and manuals.	Perform correctly.		
02.08.02.01	N	I,S	DETERMINE/ISOLATE RADIO MALFUNCTION	Given appropriate radio, checklists, and manuals.	Perform correctly.	Troubleshoot radio malfunction.	Procedures for field troubleshooting radio.
02.08.02.01.01	N	I	CHECK BATTERY/HANDSET/HEAD SET	Given appropriate radio, checklists, and manuals.	Perform correctly.	Troubleshoot failed radio and determine level of maintenance required perform field expedient maintenance.	Procedures for performing field expedient maintenance on failed radio basic troubleshooting logic for failed radios.
02.08.02.02	N	I	REPAIR TO LEVEL OF MOS	Given appropriate radio, checklists, and manuals.	Perform correctly.	Correct radio malfunction.	Procedures for removing/replacing failed external radio components.
02.08.02.03	N	I	REPLACE RADIO IF HIGHER ECHELON REPAIRS ARE NECESSARY	Given FOG-M system, appropriate radio, checklists, and manuals.	Perform correctly.	Turn in failed radio set.	Procedures for removing/replacing failed radio set.
02.09	N	I	STOW AND MAKE SECURE ALL SPARES/REPAIR KITS IN THEIR APPROPRIATE STOWAGE COMPARTMENTS	Given HMMWV, FOG-M system, and appropriate parts, checklists, and manuals.	Perform correctly within X minutes.		
02.10	N	I	STOW AND MAKE SECURE ALL PERSONAL GEAR, WEAPONS, ETC.	Given HMMWV, FOG-M system, and appropriate gear, checklists, and manuals.	Perform correctly within X minutes.		

NUMBER	ET	SKILL LEVEL	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
02.11	N	I	WRITE UP FOR MAINTENANCE	Given proper forms, checklists, and manuals.	Perform correctly.	Log in all malfunctions with a description of the malfunctions and any other relevant information.	Standard operating procedures for documenting failed equipment for repair.
03.	N	I	MOVE THE FOG-M SYSTEM	Given the HMMWV and FOG-M system and appropriate checklists and manuals.	Perform correctly.		
03.01	N	I	MOUNT AND MOVE BATTLE-READY HMMWV TO THE DESIGNATED POINT OF DEPARTURE	Given the HMMWV and FOG-M system.	Perform correctly 100% of the time.		
03.02	N	I,S,E	MOVE TACTICALLY TO DESIGNATED LAUNCH SITE	Given the HMMWV and FOG-M system and appropriate checklists and manuals.	Perform correctly, taking no more than the required time, arriving within +/- X meters of the correct destination, 90% of the time. Experts within +/- < X meters.		
03.02.01	N	I	MAINTAIN CREW AND VEHICLE SECURITY	Given HMMWV and FOG-M system and crew.	Perform correctly 100% of the time.		
03.02.02	Y	I,S,E	PERFORM LAND NAVIGATION USING VNAS SYSTEM	Given the HMMWV and FOG-M system and appropriate maps, checklists and manuals.	Perform correctly and arrive within +/- X meters. Experts arrive at precise location		
03.02.02.01	Y	I	SELECT OPERATE ON NDU	Given VNAS system		Place NDU mode switch to operate.	Location of VNAS switches/indicators.

NUMBER	ET	SKILL LEVEL	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
03.02.02.02	Y	I	SELECT DESIRED WAYPOINT OR DESTINATION ON NDU	Given VNAS system.		Select next waypoint respond to all system alerts.	Location of VNAS switches/indicators.
03.02.02.03	Y	I,S,E	IDENTIFY PLANNED REFERENCE POINTS ALONG ROUTE	Given FOG-M system and appropriate maps, instructions, checklists, and manuals.	Identify 100% of the reference points. Experts within X minutes.	Determine arrival at planned reference points.	Coordinates of reference points and recognition.
03.02.02.04	Y	I,S,E	USE VNAS TO NAVIGATE TO DESTINATION	Given VNAS and appropriate maps, instructions, checklists, and manuals.	Navigate to within +/- X meters of correct destination. Experts within +/- < X meters.	Select land navigation mode navigate to preplanned destination.	Land navigation procedures using VNAS.
03.02.02.04.01	Y	I	PRESS POWER SWITCH ON NDU	Given VNAS		Select/press VNAS power switch.	Prerequisites to selecting land navigation function location of VNAS switches/indicators.
03.02.02.04.02	Y	I	PERFORM BITE TEST	Given FOG-M system.	Interpret all results correctly.	Select/press VNAS power switch/other switches.	Prerequisites to selecting land navigation function location of VNAS switches/indicators.
03.02.02.04.03	Y	I,S	DETERMINE VNAS SYSTEM STATUS	Given VNAS.	Determine correctly	Respond to all system alerts.	Procedure for determining VNAS status.
03.02.02.05	Y	I,S	PERFORM VNAS ALIGNMENT	Given HMMWV and FOG-M system and appropriate independent direction information.	Align within +/- X degrees, within Y minutes.	Verify that prerequisite conditions for alignment are met perform alignment.	Procedure for performing alignment HMMWV restrictions during alignment.
03.02.02.05.01	N	I	POSITION HMMWV TO NORTH HEADING (+/-30 DEGREES)	Given HMMWV and VNAS.	Position within limits.	Position HMMWV for alignment.	Procedure for moving HMMWV procedure for determining HMMWV position and heading.

NUMBER	ET	SKILL LEVEL	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
03.02.02.06	N	I,S,E	LAND NAVIGATE TO BASE CAMP OR TO NEXT SITE WITH MAP AND COMPASS	Given HMMWV and appropriate maps and compass.	Arrive at site within +/- X meters. Experts arrive at precise location.	Perform land navigation without the use of the VNAS.	Procedures for land navigation with map and compass.
03.02.03	N	I	MAINTAIN MARCH DISCIPLINE	Given HMMWV in transit.	Perform correctly.		Motor march procedures.
03.03	Y	I,S	COMMUNICATE	Given radio.	Perform correctly, using proper procedure.		Communications procedures.
03.03.01	Y	I,S	COMMUNICATE USING RADIO	Given radio.	Perform correctly, using proper procedure.	Perform comm checks enroute, as briefed.	Procedure for enroute comm checks.
03.03.01.01	N	I	PERFORM CHECKS ON RADIO EQUIPMENT SUCH AS CABLES, CONNECTORS, BATTERIES, ETC.	Given radio and appropriate checklists and manuals.	Perform correctly.	Check external components of failed radio and determine level of maintenance required perform field expedient radio maintenance.	Procedure for performing checks on radio components procedure for performing field expedient maintenance on failed radio.
03.03.02	N	I,S	COMMUNICATE DESPITE LOSS OF RADIO COMMUNICATIONS	Given appropriate job aids.	Select proper mode of communication and employ it properly to communcate required information.	Ability to communicate effectively using arm/hand signals.	Proper alternative mode of communication (arm/hand signals, runner) arm/hand signals.
03.03.02.01	N	I,S	ESTABLISH COMMUNICATIONS USING ARM/HAND SIGNALS OR RUNNER	Given appropriate job aids.	Communicate information in a timely manner.	Perform lost-communications procedures.	Procedure for establishing and performing arm/hand signals procedure for preparing messages procedure for using a runner to deliver written messages.

NUMBER	ET	SKILL LEVEL	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
03.04	N	I,S,E	DEVIATE FROM PLANNED GROUP MOVEMENT DUE TO PROBLEMS IN TRANSIT	Given alternate plans.	State procedures correctly. Experts select better alternative actions and use initiative in devising solutions.	Ability to detect enemy activity and ascertain proper alternative action to accomplish mission.	How to determine that deviation is appropriate correct action.
04.	N	I,S,E	DEPLOY THE FOG-M SYSTEM AT A LAUNCH SITE	Given the HMMWV and FOG-M system and appropriate checklists and manuals.	Complete within X minutes, correcting all errors prior to completion. Experts complete without errors.		Procedure for deploying FOG-M at launch site.
04.01	N	I,S,E	SECURE TACTICAL LAUNCH SITE	Given a potential tactical launch site.	Perform correctly. Expert perform without error.		Procedure for securing a tactical launch site.
04.01.01	N	I,S,E	ENSURE LAUNCH SITE IS FREE OF ENEMY ACTIVITY AND PHYSICAL OBSTACLES	Given a potential launch site.	Perform correctly. Experts perform without errors.		Procedures/tactics to neutralize enemy activity and clear obstacles.
04.01.02	N	I	TAKE NOTES FROM INFORMATION PROVIDED BY BRIEFER	Given briefing and appropriate maps and manuals.	Perform correctly.	Read a tactical map with UTM coordinates take notes on applicable information areas.	In-depth understanding of all SOP's pertaining to the FOG-M system standard Army terminology and encronyms.
04.01.03	N	I,S,E	DETERMINE WHETHER LAUNCH SITE CAN BE SECURED	Potential launch site.	Perform correctly. Experts perform without error.	Ability to determine security.	Conditions under which securing is possible.
04.02	N	I	PREPARE LAUNCH SITE	Potential launch site, HMMWV, FOG-M system.	Perform correctly.		Procedure to prepare tactical launch site.

NUMBER	ET	SKILL LEVEL	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
04.02.01	N	I	CLEAR ANY OBSTACLES	Potential launch site.	Perform correctly.	Efficient removal of obstacles.	Whether obstacles can be cleared and how to clear them.
04.02.01.01	N	I,S,E	DETERMINE WHETHER OBSTACLES CAN BE CLEARED	Given a tactical launch site and obstacles.	Perform correctly. Expert performs without errors.		Obstacles and clearing methods.
04.03	N	I,S,E	MANEUVER HMMWV INTO POSITION AND CAMOUFLAGE	Given the HMMWV, FOG-M system, and appropriate camouflage equipment.	Perform correctly within X minutes. Expert performs without errors.		
04.03.01	N	I	DETERMINE WHETHER LAUNCHER CAN BE POSITIONED ADEQUATELY	Potential launch site.	Determine correctly without deploying launcher.		Understanding of HMMWV/launcher capabilities and terrain.
04.03.02	N	I	EMPLOY LAUNCHER/HMMWV LEVELING DEVICES, AIDED BY NATURAL MATERIALS FOUND AT SITE	Given HMMWV, FOG-M system, and launch site.	Complete launcher leveling within X minutes.	Configure launcher for firing in an area that is not level, clear, or safe.	Standard operating procedure for setting up a launch-site in an unsecured, uncleared, or unlevel area.
04.03.03	N	I,S,E	CAMOUFLAGE THE HMMWV AND LAUNCHER	Given HMMWV and launcher, FOG-M system, and launch site.	Complete within X minutes. Expert uses initiative in devising solutions and blends the camouflage more naturally with the surroundings.	Prepare HMMWV and launcher position for maximum cover and concealment.	Procedure for preparing the positions and camouflaging the HMMWV and launcher.
04.04	N	I,S,E	PREPARE GUNNER POSITION AND CAMOUFLAGE	Given HMMWV, FOG-M system, launch site, and appropriate tools.	Occupy position within X minutes.		

NUMBER	ET	SKILL LEVEL	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
04.04.01	N	I,S,E	PREPARE A SECURE POSITION FOR GUNNER'S STATION	Given the HMMWV, FOG-M system, and launch site.	Prepare position within X minutes.		
04.04.01.01	N	I,S,E	DIG, CONSTRUCT, CAMOUFLAGE GUNNER'S POSITION	Given HMMWV, FOG-M system, launch site, and standard tools.	Complete construction correctly. Expert uses initiative in devising solutions and produces a camouflage skeem that blends more naturally with the surroundings.	Prepare GS position for maximum cover and concealment.	Procedure for preparing GS position.
04.04.01.02	N	I	DEPLOY POWER CABLE BETWEEN HMMWV AND GUNNER'S POSITION	Given deployed FOG-M system.	Perform correctly.	Deploy GS power cable to GS position.	Restriction due to GS cable length and GS console configuration.
04.04.01.02.01	N	I	REPLACE LAUNCHER POWER CABLE IF DEFECTIVE	Given FOG-M system.	Perform correctly.	Inspect launcher power cable assembly and determine failed part remove/replace defective part.	Characteristics of a normally configured launcher power cable assembly procedures for removing/replacing failed parts.
04.04.01.03	N	I	REMOVE GUNNER'S CONSOLE FROM HMMWV AND EMPLACE AT GUNNER'S POSITION	Given HMMWV, FOG-M system, and launch site.	Perform correctly.	Unfasten and remove GS from HMMWV mount.	Procedure for removing/replacing GS.
04.04.01.04	N	I	CONNECT POWER CABLE TO GUNNER'S CONSOLE	Given HMMWV and FOG-M system.	Perform correctly.	Connect power cable.	Procedure for connecting power cable.

NUMBER	ET	SKILL LEVEL	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
04.05	N	I,S,E	DETERMINE WHETHER HMMWV/LAUNCHER AND GUNNER ARE PROPERLY EMPLACED	Given deployed system.	Perform correctly 100% of the time. Expert is able to state the problems with any given emplacement.		Understanding of HMMWV/launcher emplacements.
04.05.01	N	I,S,E	DETERMINE WHETHER HMMWV/LAUNCHER IS PROPERLY POSITIONED AND CAMOUFLAGED	Given deployed system.	Perform correctly 100% of the time.		Understanding of HMMWV/launcher emplacement and camouflage.
04.05.02	N	I,S,E	DETERMINE WHETHER GUNNER IS PROPERLY POSITIONED AND CAMOUFLAGED	Given teh deployed system and gunner.	Determine correctly 100% of the time.		Understandign of individual positions and camouflage.
05.	Y	I,S,E	PLAN A MISSILE FLIGHT	Given the FOG-M system.	Arrive at target within flight system parameters. Experts account for intel and all meteorological data.		Procedure for missile planning.
05.01	N	I	POWER UP FOG-M SYSTEM	Given FOG-M system and appropriate checklists and manuals.	Perform correctly within X minutes.		Procedure for FOG-M system power up.
05.01.01	N	I	CHECK FOG-M SYSTEM BATTERY LEVELS	Given FOG-M system and appropriate checklists and manuals.	Perform correctly.	Determine if correct, stable voltage present.	
05.01.01.01	N	I	TEST FOR CORRECT BATTERY LEVEL ON HMMWV CURRENT METERS	Given FOG-M system and appropriate checklists and manuals.	Perform correctly.	Read FOG-M system battery level indicators.	Procedure for checking charge level of FOG-M system batteries.

NUMBER	ET	SKILL LEVEL	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
05.02	N	I	PERFORM FOG-M SYSTEM COMPUTER POWER-UP PROCEDURE	Given FOG-M system and appropriate checklists and manuals.	Complete within X minutes, correcting all errors prior to completion.	Bring system up to operational state within (TBD) minutes.	Procedure for FOG-M system power up.
05.02.01	N	I	VERIFY THAT SYSTEM POWER IS AVAILABLE	Given FOG-M system and appropriate checklists and manuals.	Perform correctly 100% of the time.	Recognize correct/incorrect FOG-M system input power recognize hardware failures.	Characteristics of power requirements of FOG-M system.
05.02.02	N	I	PRESS POWER SWITCH	Given the FOG-M system and appropriate checklists and manuals.	Perform correctly.	Recognize correct/incorrect FOG-M system input power operate power-on switch.	Location of all FOG-M system components/controls procedure for applying FOG-M system power.
05.02.03	Y	I,S,E	DETERMINE EQUIPMENT STATUS FAILURES IDENTIFIED BY THE BITE	Given error messages and appropriate checklists and manuals.	Interpret all messages correctly. Expert is able to interpret unusual problems and devise solutions.	Recognize hardware failures.	Location of all FOG-M system components/controls indications of normal/abnormal power up location of bite information area on visual display interpretation of bite test results.
05.02.04	Y	I,S,E	DETERMINE LEVEL OF DEGRADED OPERATIONS	Given error messages and appropriate checklists and manuals.	Interpret messages correctly. Expert is able to interpret unusual problems and devise solutions.	Determine operation capabilities of the FOG-M system with system degraded.	Location of bite information area on visual display interpretation of bite test results system limitations for degraded capabilities.
05.02.05	N	I	REPORT EQUIPMENT STATUS TO HIGHER AUTHORITY	None.	Perform correctly.	Report equipment failures.	Procedures for preparing equipment failure reports and submitting equipment failure reports.

NUMBER	ET	SKILL LEVEL	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
05.02.06	N	I,S,E	REPAIR FAILED EQUIPMENT	Given FOG-M system and appropriate checklists and manuals.	Perform correctly. Expert performs field expedient repair.	Recognize correct/incorrect FOG-M system power perform FOG-M system maintenance recognize hardware failures.	Location of all FOG-M system components/controls location of bite information area on visual display interpretation of bite test results basic system troubleshooting logic procedure for removing and replacing bad FOG-M system components.
05.02.07	N	I	ADJUST VIDEO DISPLAY CONTRAST AND BRIGHTNESS	Given FOG-M system.	Perform correctly.	Adjust video display.	Location of all FOG-M system components/controls procedure for adjusting video display.
05.02.08	Y	I	ENTER DATE AND TIME	Given FOG-M system.	Perform correctly.	Enter date and time.	Location of all FOG-M system components/controls procedure for entering date and time.
05.02.09	Y	I,S	ACCEPT/CORRECT THE POSITION/HEADING CURRENTLY IN SYSTEM	Given FOG_M system.	Perform correctly.	Accept or change position/heading currently in system.	Procedure for verifying present location/heading procedure for changing present location/heading.
05.02.10	N	I,S	LOAD DMA TAPE/VIDEODISK (OPTIONAL)	Given FOG-M system and appropriate checklists and manuals.	Perform correctly.	Perform tape/disk loading.	Location of all FOG-M system components/controls procedure for loading DMA tape/videodisk.
05.02.11	Y	I,S	SELECT MAP DISPLAY (OPTIONAL)	Given FOG-M system.	Perform correctly.	Select map display.	Procedures for selecting map display.

NUMBER	ET	SKILL LEVEL	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
05.02.12	Y	I,S	SELECT NEXT MODE	Given FOG-M system.	Perform correctly.	Select next appropriate mode.	Location of all FOG-M system components/controls prerequisites for selecting next mode.
05.03	Y	I,S	ALTER DMG VIDEO DISPLAY AS NECESSARY	Given FOG-M system.	Perform correctly.		Procedure to alter DMG.
05.03.01	Y	I	SELECT MISSION PLANNING FUNCTION	Given FOG-M system, correct DMA data, and appropriate checklists and manuals.	Perform correctly.	Select mission planning PDP insert correct DMA tape/videodisk select correct map display.	Procedures for selecting FOG-M system mission planning SOP for FOG-M mission planning.
05.03.02	Y	I	SELECT DMG OR VIDEODISK	FOG-M system and correct DMA data.	Perform correctly.	Insert correct DMA tape/videodisk select correct map display.	Procedure for selecting appropriate DMG/videodisk.
05.03.03	Y	I,S	CHECK IF MAP BOUNDARIES ARE WITHIN LIMITS	FOG-M system and correct and incorrect DMA data.	Perform correctly.	Verify map boundaries are adequate for LS and target areas to be planned.	SOP for FOG-M system mission planning coordinates of LS and target areas to be planned joystick/keypad to locate coordinates on map.
05.03.04	Y	I,S	CHANGE MAP ORIENTATION	Given FOG-M system.	Perform correctly.	Select correct map display configure map to desired presentation using default values.	Procedure for configuring map presentation using default values procedure for changing map orientation using joystick controls.
05.03.05	Y	I,S	CHANGE MAP SCALE	Given FOG-M system.	Perform correctly.	Change scale using default values.	Procedure for changing map scale.

NUMBER	ET	SKILL LEVEL	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
05.03.06	Y	I,S	CHANGE CONTOUR LINE INTERVAL	Given FOG-M system.	Perform correctly.	Change map to desired contour line spacing using default values.	Procedure for changing map contour line spacing using default values.
05.03.07	Y	I,S	CHANGE SHADING METHOD FROM BAND TO SLOPE OR VICE VERSA	Given FOG-M system.	Perform correctly.	Change map shading to desired presentation using default values.	Procedure for changing map shading presentation.
05.03.08	Y	I,S	CHANGE SHADING INTERVAL WHEN IN BAND MODE	Given FOG-M system.	Perform correctly.	Change map to desired shading interval using default values.	Procedure for changing map shading interval.
05.03.09	Y	I,S	CHANGE THE NUMBER OF MAP FEATURES BEING DISPLAYED	Given FOG-M system.	Perform correctly.	Configure map features to desired presentation using default values.	Procedure for configuring map presentation.
05.03.10	Y	I,S	SLEW MAP SCENE	Given FOG-M system.	Perform correctly.	Slew map presentation to desired orientation using joystick controls.	Procedure for slewing map presentation using the joystick.
05.03.11	Y	I,S	SET A NEW MAXIMUM ALTITUDE OF MISSILE (IF NECESSARY)	Given FOG-M system.	Perform correctly.	Enter optimum flight altitude.	Procedure for determining missile optimum altitude.
05.04	Y	I,S	ENTER ROUTE TO TARGET	Given FOG-M system and data.	Perform correctly.		
05.04.01	Y	I,S	ENTER TARGET COORDINATES	Given FOG-M system and data.	Perform correctly.	Designate target position using keypad or joystick.	Procedure for entering target area coordinates using joystick and keypad.
05.04.02	Y	I,S	CONFIRM ACCURACY OF ENTERED COORDINATES	Given FOG-M system and data.	Perform correctly.	Verify coordinates entered are correct.	Procedure for determining/verifying UTM coordinates of launch site and target area.

NUMBER	ET	SKILL LEVEL	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
05.05	Y	I,S,E	PLAN ALTERNATE ROUTES TO TARGET	Given FOG-M system, appropriate map, and target locations.	Perform correctly. Expert acounts for non-obvious contingencies.		
05.05.01	Y	I,S,E	DETERMINE IF ALTERNATE ROUTES ARE NECESSARY	Given FOG-M system, appropriate map, and target locations.	Plan optimal routes. Experts accounts for non-obvious contingencies.	Plan alternate routes to target area.	Procedures for planning alternate routes reasons to change routes (terrain, meteorological conditions such as sun angle).
05.05.02	Y	I,S,E	ENTER WAYPOINTS FOR ALTERNATE ROUTES	Given FOG-M system and waypoint value.	Perform correctly. Expert accounts for non-obvious contingencies.	Insert waypoints using keypad or joystick.	Procedures for inserting route waypoints.
05.06	Y	I,S,E	RECEIVE INTELLIGENCE INFORMATION IN ORDER TO PLAN/EXECUTE MISSION	None.	Record proper pieces of information. Expert extracts subtle implications for this weapon from the intelligience information.		
06.	Y	I,S,E	PERFORM MISSILE LAUNCH	Given FOG-M system and target area data.	Complete launch within X minutes, correcting all errors prior to completion.		
06.01	Y	I,S,E	PERFORM LAUNCH PREPARATION	Given the FOG-M system, required launch data, and available missiles.	Perform at 100% level.		Missile firing procedures.

NUMBER	ET	SKILL LEVEL	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
06.01.01	Y	I,S	SELECT LAUNCH FUNCTION	Given the FOG-M system.	Perform within X minutes at 100% level.		Procedure for selecting the launch function.
06.01.01.01	Y	I,S	STATE LAUNCH SELECTION PROCEDURE	Given the FOG-M system gunner's console.	State that procedure consists of pressing launch PDP.		Location of launch PDP, correct procedure.
06.01.02	Y	I,S	CONFIRM OR CORRECT EXISTING LAUNCHER DATA (LAUNCH SITE, LAUNCHER HEADING)	Given the FOG-M system and the correct data.	Perform at 100% correct level.	Use of joystick or keypad.	Procedures for determining, confirming, or entering data.
06.01.02.01	Y	I,S	CONFIRM OR INPUT LOCATION OF LAUNCH SITE	Given the FOG-M system and the location data.	Perform correctly.	Enter launcher coordinates.	Procedure for entering launcher coordinates, using joystick or keypad.
06.01.02.02	Y	I,S	CONFIRM OR INPUT HEADING OF LAUNCHER	Given the FOG-M system and the location data.	Perform correctly.	Enter launcher heading.	Procedure for entering launcher heading using the joystick or keypad.
06.01.03	Y	I,S	ENTER MISSILE GUIDANCE DATA (MISSION TYPE, TARGET NUMBER, ROUTE NUMBER, TARGET COORDINATES, MISSILE HEADING AND AZIMUTH)	Given the FOG-M system and missile guidance data or fire mission.	Perform at 100% correct level.	Determining mission type, using PDP, using joystick, using keypad, map reading.	Procedure to enter missile guidance data (mission type, target number, route number, target coordinates, missile heading).
06.01.03.01	Y	I,S	DETERMINE MISSION TYPE	Given a fire mission.	State the three mission types.	Select azimuth/range only, preplanned, or target coordinates, determining mission type.	Procedure for determining mission type (appropriate firing mode) and data required for each mission type.

NUMBER	ET	SKILL LEVEL	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
06.01.03.02	Y	I,S	SELECT MISSION TYPE	Given the FOG-M system.	Perform correctly.	Select either azimuth/range only, preset route, or target coordinates.	Procedure for determining appropriate firing mode.
06.01.03.03	Y	I,S	ENTER TARGET NUMBER AND MISSILE ROUTE NUMBER FROM PREVIOUS MISSION PLANNING	Given the FOG-M system and required data.	Perform correctly.	Enter appropriate target/route number.	Procedure for entering target number/route number, using the keypad.
06.01.03.04	Y	I,S	SELECT OR ENTER COORDINATES OF THE TARGET AREA	Given the FOG-M system and the required data.	Perform correctly.	Designate launch/target position using keypad or joystick.	Procedure for entering LS and target area coordinates using joystick and keypad.
06.01.03.05	Y	I,S	SELECT OR ENTER MISSILE HEADING AZIMUTH	Given the FOG-M system and the required data.	Perform correctly.	Enter appropriate initial heading for missile.	Procedure for entering missile heading using keypad.
06.01.04	Y	I,S	SELECT NUMBER OF MISSILES TO BE FIRED	Given the FOG-M system and the required data.	Perform correctly.		
06.01.04.01	Y	I,S	CONFIRM THAT ENOUGH MISSILES ARE AVAILABLE FOR MISSION	Given the FOG-M system.	Perform at 100% level.	Display mission status tableau, verify number of missiles present.	Procedure for displaying missile status tableau.
06.01.04.02	Y	I,S	ENTER NUMBER OF MISSILES TO BE FIRED	Given the FOG-M system and the reqquired data.	Perform correctly.	Enter number of missiles for next SALVO.	Procedure for entering number of missiles in SALVO using keypad.
06.01.04.03	Y	I,S	SELECT CORRELATOR IF DESIRED	Given the FOG-M system and a preflown mission with which to correlate.	Gunner must know that preplanned or nonplanned missions can use correlator if video data are available.	Select correlator, determining when correlator is appropriate.	Procedure for manually selecting correlator, how to determine if correlator is appropriate.

NUMBER	ET	SKILL LEVEL	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
06.01.04.03.01	N	I,S,E	UNDERSTAND OPERATION OF CORRELATOR FOR LEAD/SINGLE MISSILE AND FOR FOLLOWING MISSILES	None.	Understand principles and procedures. Expert understands reasons for correlator problems.		
06.02	Y	I	LAUNCH MISSILE	Given the FOG-M system, one or more available missiles, and clear launch conditions.	Fully successful launch.	Determining when all preconditions for launch have been met.	Procedure to launch missile.
06.02.01	Y	I	OPERATE LAUNCH SWITCH	Given the FOG-M system.	Perform correctly.		
06.03	Y	I,S	RESPOND TO FAILURE OF MISSILE TO FIRE	Given the FOG-M system, and missile failure.	Begin firing of next missile within 1 minute of failure.		Procedure for failed missile firing, automatic actions that may occur after failure, manual actions that may be taken.
06.03.01	N	I	STATE MAJOR CONTINGENCIES DURING MISSILE LAUNCH	Given the FOG-M system gunner's console.	State both contingencies.		Missile fails to fire, missile hangs up.
06.03.01.01	N	I	STATE RESPONSE TO FAILURE OF MISSILE TO FIRE	None.	State correctly in order.		Indications of missile failure to fire, appropriate response to missile failure to fire.
06.03.02	N	I,S	RESPOND TO HUNG MISSILE	Given the FOG-M system and hung missile.	State the four steps in order and without error.		Procedure for hung missile - 1. Open circuit breaker. 2. Remove hung missile from launcher. 3. Close circuit breaker. 4. Fire next missile.

NUMBER	ET	SKILL LEVEL	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
06.03.03	Y	I,S	ABORT LAUNCH OF MISSILE	Given the FOG-M system and indications for abort.	Perform abort before missile fires.	Perform abort determination and procedure.	Procedure to abort launch, indications for launch abort.
06.03.03.01	Y	I,S	SKIP MISSILE MANUALLY	Given the FOG-M system with a hung-up missile.	Complete from receiving indication of hang-up to readiness to fire another missile, without performing the disposal step, within X minutes.	Verify launcher is grounded *safe all missiles* remove hung missile open circuit breakers dispose of faulty missile per S.O.P.	Procedure for verifying grounding procedure for safing missile procedure for handling live missiles procedure for removing hung missiles procedure for disposing of faulty missiles.
06.03.03.01.01	N	I	DISPOSE OF FAULTY MISSILE	Given FOG-M missile.	Perform at 100% level.	Use of standard military explosives.	Procedure for destruction of faulty missiles.
06.03.04	Y	I	ATTEMPT TO REFIRE AN UNFIRED MISSILE	Given FOG-M system and representation of missile that has failed to fire.	Perform at the 100% level.	Select a misnile to be fired using the PDP controls and keypad fire the selected missile.	Procedure for selecting a specific missile for firing procedures for firing missile.
07.	Y	I,S,E	USE THE SEEKER	Given FOG-M system and video of cruise.	Show ability to operate seeker to find target areas, *and demonstrate* understanding of relationship between seeker direction and missile movement.		
07.01	Y	I,S	ADJUST SEEKER VIDEO	Given FOG-M system and a variety of seeker video scenes.	Adjust to maximize visual perception of scene.	Adjust seeker video as appropriate.	Controls used to adjust seeker video, procedures to adjust seeker video.

NUMBER	ET	SKILL LEVEL	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
07.01.01	N	I	KNOW SEEKER VIDEO CONTROLS	Given FOG-M system and seeker video.			
07.01.01.01	N	I	STATE LOCATIONS OF ALL CONTROLS THAT ADJUST SEEKER VIDEO	Given the FOG-M system gunner's console.	Name and locate each control.		Location of iris, contrast, and brightness controls.
07.01.01.02	N	I	STATE ADJUSTMENTS TO BE MADE TO SEEKER VIDEO	Given the FOG-M system gunner's console.	State the functions of each control.		Iris, contrast, and brightness control functions/locations.
07.01.02	Y	I,S	ADJUST BRIGHTNESS AND CONTRAST OF VIDEO DISPLAY	Given the FOG-M system and video display.	Adjust to desired level.	Adjust video display when necessary.	Location and operation of brightness/contrast and contrast direction controls on the gunner's console, appropriate video level for best navigation and target discrimination.
07.01.03	Y	I,S	SELECT APPROPRIATE SEEKER IRIS DIAMETER	Given the FOG-M system and a variety of target area scenes of varying brightness.	Adjust so wide range of targets is identifiable quickly.	Quickly adjust iris to optimize seeker video contrast.	Location and operation of MAN/AUTO and OPEN/CLOSE IRIS switches on gunner's console.
07.01.03.01	Y	I,S	READJUST BRIGHTNESS AND CONTRAST OF VIDEO DISPLAY FOLLOWING IRIS ADJUSTMENT	Given the FOG-M system.	Perform correctly.	Adjust video display.	Location and operation of brightness/contrast controls on the gunner's console.
07.01.03.02	N	I	STATE ACTIONS TO TAKE WHEN SEEKER IRIS ADJUSTMENT FAILS	Given the FOG-M system, seeker video with iris failure in various light conditions.	State actions correctly.		Procedures to invoke (change course, look away from sun, adjust CRT brightness and contrast).

NUMBER	ET	SKILL LEVEL	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
07.01.03.03	Y	I,S,E	NAVIGATE WHEN SEEKER IRIS ADJUSTMENT FAILS	Given the FOG-M system and iris adjustment failure during cruise, flying into sun.	Minimize seeker view problems.	Adjust contrast and brightness of display CRT, recognize terrain features under conditions of poor contrast and brightness, rapid map reading.	Procedures to invoke (CRT adjustment, flight path change), indications of seeker iris failure.
07.01.04	Y	I,S	CHANGE TRACKER CONTRAST DIRECTION IF SELECTED TARGET IS BRIGHTER THAN BACKGROUND	Given the FOG-M system and targets of higher and lower brightness than the background.	Perform correctly 100% of the time.	Ability to descriminate contrast of target vs. background and vice versa.	Procedure to change tracker contrast.
07 01.05	N	I	STATE APPROPRIATE ACTION WHEN NO SEEKER VIDEO PRESENT WHEN MISSILE LEVELS OFF INTO CRUISE	None.	State action to take		Knowledge of procedures (check video display, iris control, seeker slew), maintain missile altitude to attempt to reach target area.
07.02	Y	I,S,E	OPERATE SEEKER SLEW TO OBSERVE TERRAIN AND OBJECT FEATURES	Given the FOG-M system and cruise video.	Operate seeker smoothly. Expert minimizes seeker adjustment time.	Smooth operation of seeker slew control.	Procedure to operate slew without altering missile cruise parameters, and maximize use of seeker video.
07.02.01	Y	I,S,E	MAINTAIN KNOWLEDGE OF ORIENTATION OF SEEKER VS. MISSILE WHILE SEEKER IS SLEWED	Given the FOG-M system, cruise video, and seeker slewed from straight ahead.	Indicate position of seeker relative to missile within 45 degrees in any direction. Expert indicates position to within 25 degrees.	Ability to orient seeker vs. missile in space.	

NUMBER	ET	SKILL LEVEL	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
07.02.02	Y	I,S,E	DISCRIMINATE TARGET AREA FROM BACKGROUND VIDEO	Given FOG-M system and seeker video display of varied typical scenes.	Perform at 100% level. Expert discriminates the target area from a greater distance.	Ability to slew seeker and to recognize potential target areas from background.	Cues that differentiate moving from still objects and cues that differentiate objects from background.
07.02.03	Y	I,S,E	SLEW SEEKER TO CENTER THE TARGET AREA ON THE VIDEO DISPLAY	Given the FOG-M system and cruise video with multiple target areas.	Center target area within 5 seconds of its appearance on the video display. Expert minimizes seeker adjustment time.	Manually slew seeker to center the target area, using joystick controls.	Procedure for switching to manual missile navigation, procedure for manually steering missile, location of target.
07.02.05	Y	I,S,E	MAINTAIN OPTIMUM SEEKER ORIENTATION AND ZOOM	FOG-M system and cruise video.	Perform correctly. Expert maintains to closer tolerances.	Manipulation of seeker zoom controls.	Understanding of how to maintain orientation
07.03	Y	I,S,E	OPERATE SEEKER ZOOM	Given FOG-M system, and cruise video.	Zoom in and out appropriately. Maintain orientation while using zoom. Expert zooms in without losing track of any detail.	Operate zoom without loss of missile orientation.	Understanding of how maintain orientation.
07.03.01	N	I	STATE ACTIONS TO TAKE WHEN SEEKER ZOOM FAILS	Given the FOG-M system, seeker video, and seeker zoom failure.	State actions correctly.		Procedures to invoke.
07.03.02	Y	I,S,E	NAVIGATE WHEN SEEKER DOES NOT ZOOM	Given the FOG-M system and failure to zoom seeker during cruise.	Navigate missile to target area +/- X km. Expert navigates to within < +/- X km.	Identify landmarks without close-up look.	Indication of seeker zoom failure.

NUMBER	ET	SKILL LEVEL	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
07.04	Y	I,S,E	OPERATE SEEKER AND VIDEO FOR MULTIPLE MISSILES IN A SALVO	Given FOG-M system and multi-missile launch.	Expert views multiple missiles comfortably.		
07.04.01	Y	I	SWITCH TO SEEKER OF NEXT MISSILE	Given FOG-M system and multi-missile seeker video in cruise.	Perform correctly.	Switch video display to alternate missile using PDP controls determine whether missile or gunner station video has failed abort launch on further missiles if gunner station has failed.	Procedure for switching seeker video display to another missile using PDP controls procedures for verifying that desired missile video is displayed procedure for aborting SALVO in progress.
07.04.02	Y	I,S	OBSERVE SEEKER VIDEO FROM OTHER AIRBORNE MISSILES	Given FOG-M system and multi-missile seeker video in cruise.	Perform correctly, maintaining control of all missiles.	Obtain seeker video display of desired missile(s).	Procedure for displaying video from any airborne missile.
07.04.03	Y	I,S	SLEW/ZOOM SEEKER OF NEW LEAD MISSILE TO VIEW PREVIOUS TARGET	Given FOG-M system and multi-missile seeker video in cruise, with all missiles launched to the same target area.	Find target within 10 seconds.		
08.	Y	I,S,E	CONTROL MISSILE FLIGHT	Given FOG-M system, correct data.	Perform all verifications correctly correct any errors within 5 seconds.		
08.01	Y	I,S	VERIFY PITCH, ROLL, AZIMUTH, ALTITUDE	Given the FOG-M system console and video of launch and cruise.	Perform at 100% level.		Know where the displays are that show these data.
08.01.01	N	I	STATE THE DISPLAYS THAT ARE USED TO VERIFY PITCH, ROLL, AZIMUTH, ALTITUDE	Given the FOG-M system console.	Describe displays correctly.		

NUMBER	ET	SKILL LEVEL	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
08.01.02	Y	I,S	VERIFY CORRECT PITCH	Given the FOG-M system and cruise video.	Read pitch readout correctly.	Observe missile pitch.	Location of pitch readout on video display, proper pitch and pitch range.
08.01.03	Y	I,S	VERIFY CORRECT ROLL	Given the FOG-M system and cruise video.	Verify roll readout correctly.	Observe and adjust missile roll.	Location of roll readout on video display, procedure for manually adjusting missile roll, proper missile roll and roll range, location of ALT INCR/ROLL switch.
08.01.04	Y	I,S	VERIFY CORRECT INITIAL AZIMUTH	Given the FOG-M system and cruise video, perform immediately after pitchover.	Verify initial azimuth correctly at proper time.	Change missile heading, using joystick controls.	Location of azimuth readout on the video display, location of MAN/AUTO NAV switch and SLEW control on joystick, procedure for manually changing missile heading, precision required.
08.01.05	Y	I,S	VERIFY CORRECT ALTITUDE	Given the FOG-M system and cruise video.	Verify altitude readout correctly.	Observe and adjust missile altitude.	Location of altitude readout on video display, procedure for manually adjusting missile altitude, proper altitude and altitude range, location of ALT INCR/ROLL switch.
08.02	Y	I,S,E	ADJUST MISSILE PITCH, ROLL, AZIMUTH, AND ALTITUDE	Given the FOG-M system gunner's console and cruise video in manual mode.	Adjust within +/- 1 degree. Expert makes adustment smoothly and without need for correction.		

NUMBER	ET	SKILL LEVEL	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
08.02.01	N	I	STATE THE CONTROLS THAT CONTROL ALTITUDE, PITCH, ROLL, AND AZIMUTH (YAW)	Given the FOG-M system gunner's console.	Identify the controls correctly.		Altitude, pitch, roll, and azimuth (yaw) control functions/locations.
08.02.02	Y	I,S,E	ADJUST MISSILE PITCH	Given the FOG-M system and cruise video in manual mode.	Adjust within +/- 1 degree.	Operate joystick pitch/yaw/slew switch, coordinate with pitch readout on video display.	Procedure to adjust missile pitch by switching to MAN NAV, relationship of missile pitch to missile altitude, procedure to restore level cruise by restoring AUTO NAV.
08.02.03	Y	I,S,E	ADJUST MISSILE ROLL	Given the FOG-M system and cruise video in manual mode.	Maintain roll so that missile remains on course.	Operate console roll switch, coordinate with roll readout on video display.	Procedure to adjust missile roll, relationship of roll to missile flight.
08.02.04	Y	I,S,E	ADJUST MISSILE AZIMUTH	Given the FOG-M system and cruise video in manual mode.	Adjust missile azimuth to within +/- .5 degree.	Operate joystick yaw control and coordinate with heading readout.	Procedure to adjust missile azimuth.
08.02.05	Y	I,S,E	ADJUST MISSILE ALTITUDE	Given the FOG-M system and cruise video over varied terrain in manual mode.	Maintain altitude above terrain.	Operate ALT INCR/ROLL switch.	Procedure to change altitude, ALT INCR/ROLL switch location, altitude readout.
08.02.06	Y	I	SWITCH TO MANUAL CONTROL OF MISSILE	Given the FOG-M system.	Perform correctly.	Switch from auto to man control on the joystick man/auto nav control switch correct missile altitude & attitude using the alt incr/roll control on the gunner console correct missile heading using the slew control on the joystick.	Procedure for switching to man missile navigation procedures for manually correcting missile attitude, altitude, and heading.

NUMBER	ET	SKILL LEVEL	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
08.03	Y	I,S,E	RETURN MISSILE TO ORIGINAL COURSE	Given the FOG-M system, cruise video of missile off course.	Resume original azimuth +/- X degrees within Y meters of original course. Expert makes adjustment smoothly and without need for correction.	Ability to calculate course correction.	Use of missile azimuth control.
08.04	Y	I,S	MONITOR VIDEO DISPLAY TO CONFIRM THAT CORRECT INITIAL CRUISE ALTITUDE, ATTITUDE, AND COURSE HAVE BEEN ESTABLISHED	Given the FOG-M system and cruise video.	Verify and control pitch, roll, initial azimuth, and altitude.	Interpret video display to determine need for correction.	Proper ranges for missile altitude, attitude, and course, location of missile parameter readouts.
08.04.01	Y	I,S	VERIFY CORRECT ROLL AND ADJUST IF NECESSARY	Given FOG-M system and cruise video.	Perform correctly.	Observe and adjust missile roll.	Location of roll readout in video display procedure for manually adjusting missile roll.
08.04.02	Y	I,S	VERIFY CORRECT ALTITUDE AND ADJUST IF NECESSARY	Given the FOG-M system, cruise video.	Perform correctly.	Observe and adjust missile altitude.	Location of altitude readout on video display procedure for manually adjusting missile altitude.
08.04.03	Y	I,S	VERIFY CORRECT INITIAL AZIMUTH AND ADJUST IF NECESSARY	Given FOG-M system and cruise video.	Perform correctly.	Verify initial missile heading change missile heading, using joystick controls.	Location of azimuth readout on the video display location of man/auto nav switch and slew control on joystick procedure for manually changing missile heading.

NUMBER	ET	SKILL LEVEL	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
08.05	Y	I,S,E	MAINTAIN MISSILE IN STEADY FLIGHT UNDER ADVERSE METEOROLOGICAL CONDITIONS	Given FOG-M system, cruise video, and adverse meteorological conditions.	Maintain missile flight. Experts maintain flight with no major deviations.		Procedure for adverse weather condition launches and flight.
08.05.01	Y	I,S,E	CORRECT FOR WINDSHEAR				
08.05.02	Y	I,S,E	CORRECT FOR UPDRAFT/DOWNDRAFT				
08.05.03	Y	I,S,E	MAINTAIN STEADY FLIGHT UNDER CHANGING LIFT CONDITIONS (RAIN, HEAR, ICING)				
08.06	Y	I,S,E	CONTROL MULTIPLE MISSILES	Given the FOG-M system.			
09.	Y	I,S,E	NAVIGATE A MISSILE SALVO	Given the FOG-M system.	Navigate up to three missiles in a salvo to reach the same target area at the 100% level. Expert maintains close control of the missiles and responds correctly to all contingencies and and multiple targeting.	Control manipulations for multiple missiles.	Procedures for multi-missile launches.
09.01	Y	I,S,E	USE MAP DISPLAY AND RELATE TO VIDEO	Given the FOG-M system gunner's console, seeker video, and computer generated map displays.	Relate map topography to seeker video at 100% level.	Map reading.	Map reading, map symbology related to seeker video.

NUMBER	ET	SKILL LEVEL	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
09.01.01	Y	I	SWITCH BETWEEN SEEKER VIDEO AND MAP DISPLAY	Given the FOG-M system gunner's console.	State/perform procedure without error.		Location of ALT DISP switch, procedure to switch between seeker video and map display.
09.01.02	Y	I,S,E	IDENTIFY CORRESPONDING LANDMARKS ON MAP DISPLAY AND SEEKER VIDEO	Given the FOG-M system, still and moving seeker video of a specified region, and a map display of the same region.	Identify landmarks from map to seeker and vice versa, on moving video, on first viewing of video. Perform at 75% level. Expert performs at 100% level.	Map reading.	Change display function, key features on map and video, map symbology, specific terrain (lay of the land) as represented on map.
09.03	Y	I,S,E	VERIFY INITIAL HEADING AND HEADING CHANGES USING SEEKER VIDEO AND ADJUST IF NECESSARY	Given the FOG-M system, cruise, and assigned landmarks.	Navigate to target area at 100% level.	Find key landmarks on seeker video that correspond to selected landmarks on the map display, verify course, adjust course if necessary.	Procedure for obtaining map display, map symbology, procedure for changing missile course, using joystick controls.
09.04	Y	I,S,E	NAVIGATE MULTIPLE AIRBORNE MISSILES	Given the FOG-M system.	Navigate up to three missiles to the target area at the 100% level.	Control manipulations for multiple missiles.	
09.04.01	Y	I,S,E	ADJUST LEAD MISSILE COURSE AS REQUIRED	Given the FOG-M system and cruise video.	Return to course within +/- X degrees and +/- Y meters within Z seconds.	Change missile heading, using joystick controls.	Location of man/auto nav switch location of slew control switch on joystick procedure for manually changing missile heading.

NUMBER	ET	SKILL LEVEL	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
09.04.01.01	Y	I,S,E	DETERMINE REQUIRED CONTROL INPUTS FOR COURSE CORRECTION	Given the FOG-M system, missile off course (altitude, pitch, heading, roll).	Return to course so that missile arrives within +/- X km of target area, Y seconds prior to fuel termination.	Rapid map reading rapid recognition of landmarks.	Course to target area.
09.04.02	Y	I,S,E	OBSERVE SEEKER VIDEO FROM OTHER AIRBORNE MISSILES	Given the FOG-M system and video from multiple missiles.			
09.05	Y	I,S,E	USE CORRELATOR	Given FOG-M system.	Perform in both single and multi-missile salvos.		
09.05.01	Y	I	USE CORRELATOR FOR SINGLE MISSILE NAVIGATION	Single missile or lead missile.	Perform at 100% level.		
09.05.02	Y	I	USE CORRELATOR FOR FOLLOWING MISSILE NAVIGATION	Multiple missile salvo.	Perform at 100% level.		
09.05.03	Y	I,S,E	RESPOND TO MISSILE FAILURE TO FOLLOW LEAD MISSILE	Given FOG-M system in multi-missile salvo.	Take appropriate action in time to get following missiles to target area. Use correlator as appropriate.		
09.05.03.01	Y	I,S,E	RESPOND TO CORRELATOR NOT WORKING	Given FOG-M system and representation of correlator failure.	Respond in time to get following missiles to target area.		

NUMBER	ET	SKILL LEVEL	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
09.05.03.01.01	Y	I,S,E	RECOGNIZE THAT CORRELATION HAS FAILED AND CAUSE OF FAILURE	Given the FOG-M system and failure of correlation during cruise.	Recognize problem and make distinction within 15 seconds.	Ability to assess correlator failure.	Distinction between correlator failure and failure to achieve adequate index of correlation.
09.05.03.01.01.01	Y	I,S,E	STATE DISTINCTION BETWEEN CORRELATOR FAILURE AND FAILURE TO ACHIEVE SATISFACTORY INDEX OF CORRELATION.	None.	State correctly.	Ability to discriminate between correlator failure and correlator malfunction.	Proper range of correlator index of correlation (similarity).
09.05.03.01.02	Y	I,S,E	WHEN CORRELATOR FAILS, SWITCH CONTROL TO PROBLEM MISSILE IF LEAD MISSILE IS NOT IN TERMINAL PHASE	Given FOG-M system and failure of correlator in cruise.	Perform correctly.	Obtain seeker video display of problem missile.	Indications of correlator failure on a specific missile procedure for displaying seeker video from any airborne missile.
09.05.03.01.03	Y	I,S,E	MANUALLY TRACK EACH MISSILE IN THE VOLLEY	Given the FOG-M system and a multi-missile salvo.	Maintain three missiles on course simultaneously.	Manually fly missile with least amount of time to target impact.	Procedures for switching to man navigation procedures for manually correcting missile attitude & heading mission limitations with no correlator function available procedures for deselecting launch of remaining unfired missiles in SALVO.
09.05.03.02	Y	I,S,E	RESPOND TO WORKING CORRELATOR THAT CANNOT ACHIEVE AN ACCEPTABLE INDEX OF SIMILARITY	Given the FOG-M system and failure to give an acceptable index of correlation.	Make determinations within 15 seconds.		

NUMBER	ET	SKILL LEVEL	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
09.05.03.02.01	Y	I,S,E	DETERMINE ADEQUACY OF INDEX OF CORRELATION	Given the FOG-M system and cruise data.	Make determination within 30 seconds.		
09.05.03.02.02	Y	I,S,E	ADJUST PATH OF PROBLEM MISSILE TO ATTEMPT TO REINSTATE CORRELATION	Given the FOG-M system and missile that can be restored.	Restore within 30 seconds.	Change problem missile heading to proper heading.	Location of man/auto nav switch and slew control on joystick location of alt display and change map switches procedure for manually changing missile heading.
10.	Y	I,S,E	DETECT/RECOGNIZE/IDENTIFY TARGETS	Given seeker video of the appropriate type.	Select 90% of enemy targets and 0% of friendly targets.		
10.01	Y	I,S,E	DETECT TARGET(S)	Given the FOG-M system, cruise, possible targets, visual obscuration, camouflage.	Detect possible targets 100% of time, within 3 seconds of their appearance. Expert reduces false alarms.	Ability to rapidly detect targets from other video images.	Visual cues indicating a possible target.
10.01.01	Y	I,S,E	DISCRIMINATE TARGET AREA FROM BACKGROUND VIDEO	Given the FOG-M system, cruise video containing targets, standard camouflage, and visual obscuration.	Discriminate target area 100% of the time. Expert performs in < X seconds.	Discriminate foreground objects from background, perform task under conditions of visual obscuration and camouflage.	Features that specify near and distant objects (edges, relative motion and other 3-dimensional cues, gradients.
10.01.01.01	Y	I,S,E	KNOW VISUAL CUES THAT SUGGEST THAT A VISUAL PATTERN IS A TARGET	Given the FOG-M system, cruise video containing visual cues suggesting presence of targets.	Familiar with cues to depth, ablity to discern camouflaged objects.	Ability to discern camouflaged objects.	Cues to depth.

NUMBER	ET	SKILL LEVEL	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
10.01.02	Y	I,S,E	DETECT TARGETS THAT ARE CAMOUFLAGED	Given the FOG-M system and cruise video over targets using various forms of camouflage.	Identify targets 75% of the time that they are on the screen during standard cruise. Expert identifies targets 100% of the time.	Ability to discriminate targets under various froms of camouflage.	Visual cues indicating the presence of targets.
10.01.03	Y	I,S,E	DETECT TARGETS IN VISUAL OBSCURATION (SMOKE, VEGETATION, FOG, AND RAIN)	Given the FOG-M system and cruise video over targets obscured by smoke, vegetation, or fog.	Detect targets 75% of the time. Expert detects targets 90% of the time.	Ability to detect targets under various froms of obscuration.	Visual cues indicating the presence of targets.
10.02	Y	I,S,E	RECOGNIZE/IDENTIFY TARGET(S)	Given FOG-M system and cruise video.	Recognize 90% of enemy targets and 0% of friendly targets. Expert recognizes 100% of the enemy targets and 0% of the friendly targets.		
10.02.01	Y	I,S	ZOOM IN ON TARGETS	Given the FOG-M system, cruise (& obscuration) over multiple targets and non-targets, mixed throughout the cruise.	Zoom in on target within 5 seconds of its appearance on video display.	Determine promising targets from all target aspects under conditions of obscuration and target distractors, ability to center target areas, ability to discriminate targets from non-targets, discriminate high from low priority targets.	Characteristics of promising targets.
10.02.02	Y	I,S,E	DISCRIMINATE BETWEEN BRIEFED TARGETS AND OTHER TARGETS THAT MAY BE PRESENT	Given the FOG-M system, single briefed target, alternative targets, obscuration.	Select briefed target correctly 9 out of 10 times. Expert performs at the 100% level.	Recognize the briefed target at all target aspects under conditions of obscuration and target distractors.	Characteristics of targets, characteristics of non-targets.

NUMBER	ET	SKILL LEVEL	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
10.02.03	Y	I,S,E	DIFFERENTIATE BETWEEN HIGH-PRIORITY AND LOW-PRIORITY ENEMY TARGETS	Given the FOG-M system, cruise over multiple targets.	Assign targets to high or low priority, assign 9 out of 10 targets to the correct category. Expert peforms at the 100% level.	Rapidly determine target priorities.	Factors and procedures to determine target priorities.
10.02.03.01	Y	I,S,E	COMPARE/CLASSIFY TARGETS ON THEIR THREAT MAGNITUDE TO FRIENDLY FORCES	Given the FOG-M system and cruise over varied targets.	Classify into high vs. low threat 9 times out of 10. Expert performs at 100% level.	Identify targets of interest and select the targets with the greatest threat to friendly forces, classify targets by type, by comparing target video to briefed target recognition features.	Characteristics of potential FOG-M targets.
10.02.03.02	Y	I,S,E	COMPARE AND CLASSIFY TARGETS ON THE BASIS OF THEIR VULNERABILITY TO FOG-M.	Given FOG-M system and cruise over varied targets.	Classify into high vs. low vulnerability 9 out of 10 times. Expert performs at the 100% level.	Ability to classify one target from another with respect to their vulnerability to FOG-M.	Vulnerability of targets to FOG-M.
10.02.04	Y	I,S,E	DIFFERENTIATE BETWEEN TARGETS AND FRIENDLIES	Given the FOG-M system and cruise over targets and friendlies (non-targets).	Discriminate between targets and friendlies 100% of the time.	Differentiate between targets and friendlies, perform task under all target aspects, under conditions of obscuration and target distractors.	Characteristics of friendlies, characteristics of targets.
10.02.05	Y	I,S,E	RECOGNIZE/IDENTIFY TARGETS IN OBSCURATION AND MASKED BY CAMOUFLAGE				

NUMBER	ET	SKILL LEVEL	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
10.02.05.01	Y	I,S,E	RECOGNIZE/IDENTIFY TARGETS IN VISUAL OBSCURATION	Given FOG-M video and targets masked by obscuration.			*Pattern recognition under conditions of visual obscuration and camouflage.*
10.02.05.02	Y	I,S,E	RECOGNIZE/IDENTIFY TARGETS MASKED BY CAMOUFLAGE				
11.	Y	I,S,E	ACHIEVE LOCK-ON AND/OR GUIDE MISSILE DURING TERMINAL PHASE	Given FOG-M system and cruise video containing targets.	Lock-on or guide missile to target with 95% average probability of target kill. Expert achieves 100% probability of kill.		Procedure to lock on.
11.01	Y	I,S,E	SLEW CROSSHAIRS ONTO TARGET AND MAINTAIN THEM ON TARGET	Given the FOG-M system, cruise over a single target, under conditions of obscuration.	Maintain crosshairs on target for 15 seconds out of 20, counted from first target centering. Expert maintains crosshairs on target for 20 out of 20 seconds.	Target tracking, perform under conditions of visual obscuration without breaking track on target.	Procedure to slew and maintain seeker/crosshairs on the target.
11.02	Y	I,S,E	PERFORM AND VERIFY TARGET LOCK-ON	Given the FOG-M system and target centered under crosshairs.	Perform correctly 100% of the time.	Target tracking.	Behavior of missile when locked and not locked onto target. Missile lock is indicated by depression of seeker indicator to 18 degrees, followed by rise of seeker position and depression of missile.
11.02.01	Y	I,S,E	VERIFY PORTION OF TARGET LOCKED ON	Given the FOG-M and locked target.	Assess correctly within 5 seconds.	Judge where the lock-on box is centered.	Vulnerable parts of target to use for lock-on.

NUMBER	ET	SKILL LEVEL	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
11.02.02	Y	I,S,E	RECOGNIZE THAT MISSILE HAS FAILED TO LOCK	Given the FOG-M system, terminal phase, failure to lock-on.	Recognize failure to lock-on within 5 seconds, 100% of the time.	Ability to recognize indications that the missile failed to lock onto selected target.	Characteristics of failure to lock-on target.
11.02.02.01	Y	I,S,E	GUIDE MISSILE TO TARGET MANUALLY	Given the FOG-M system, target lock-on, unannounced failure of correlator or autotracker.	Assume manual control and guide missile to impact moving target 90% of time and to stationary target 100%. Expert kills all targets with 100% probability.	Manual control of missile.	Symptoms of autotracker or correlator failure, procedure for switching to MAN NAV, procedure for manually steering missile, location of target.
11.02.02.01.01	Y	I,S,E	GUIDE MISSILE TO STATIONARY TARGET MANUALLY, IN CASE OF AUTOTRACKER OR CORRELATOR FAILURE	Given FOG-M system, terminal phase, target lock-on to stationary target.	Guide missile to target impact 100% of the time.	Manual control of missile.	Procedure for switching to manual missile navigation, procedure for manually steering missile, location of target.
11.02.02.01.02	.	I,S,E	GUIDE MISSILE TO MOVING TARGET MANUALLY, IN CASE OF AUTOTRACKER OR CORRELATOR FAILURE	Given the FOG-M system, terminal phase, no target lock-on.	Guide missile to actual target impact 90% of the time. Kill all targets at 100% probability.	Manual control of missile.	Procedure for switching to manual missile navigation, procedure for manually steering missile, location of target.
11.02.03	Y	I,S,E	RECOGNIZE THAT MISSILE HAS LOCKED ONTO THE INCORRECT TARGET	Given the FOG-M system and lock onto friendly or low priority target.	Recognize friendly target in time to take evasive action 100% of the time. Recognize low priority target 80% of the time.		Location of center of seeker lock.

NUMBER	ET	SKILL LEVEL	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
11.03	Y	I,S,E	BREAK TARGET LOCK-ON	Given the FOG-M system, target lock-on, and missile closing on target or non-target or incorrect part of target.	Perform correctly 100% of the time, within 15 seconds.		Reasons (incorrect target or part of target) and procedures to break target lock-on.
11.03.01	N	I	STATE REASONS TO BREAK TARGET LOCK-ON	None.	State reasons correctly.		Reasons to break target lock-on.
11.03.02	N	I	STATE PROCEDURE TO BREAK TARGET LOCK-ON	None.	State procedure correctly.		Procedure to break target lock-on, reasons to break target lock-on.
11.03.03	Y	I,S,E	SWITCH LOCK FROM ONE TARGET TO A MORE DESIRABLE TARGET IF TIME PERMITS	Given the FOG-M system, terminal phase, lock-on, alternative targets of higher priority.	Switch 80% of the time it is appropriate, hit some target (high or low priority) 90% of the time.	Break lock, using joystick trigger, lock onto new target.	Procedure for breaking autotrack, procedure for manually controlling missile flight, procedure for establishing lock-on, location of appropriate controls.
11.03.03.01	Y	I,S,E	DETERMINE WHETHER ALTERNATIVE TARGET IS WORTH BREAKING LOCK-ON TO SWITCH AUTOTRACKER	Given FOG-M system, terminal phase with target locked-on, alternative targets.	Selection with 10 seconds remaining to impact make selection 80% of the time that it is appropriate.	Target priority assignment, assess adequacy of time available, break lock-on, center target, lock-on.	Target priorities, lock-on and break lock-on procedures.
11.03.03.02	Y	I,S,E	BREAK LOCK-ON AND SWITCH TO UNGUIDED CRUISE IF TARGET IS IDENTIFIED AS NON-TARGET	Given the FOG-M system, lock-on, and target is identified as non-target.	Perform correctly within 5 seconds 100% of the time.	Break autotrack, using joystick controls, fly missile to alternate target or into ground.	Target vs. non-target characteristics, procedure for selecting MAN NAV, procedure for manually steering the missile.
11.04	Y	I,S,E	LOCK ON SEQUENTIAL MISSILES IN SALVO	Given the FOG-M system and multi-missile salvo.	Perform correctly 100% of the time for up to three missile salvo.	Find, track, and lock onto new target.	Target characteristics procedure for locking onto target.

NUMBER	ET	SKILL LEVEL	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
12.	Y	I,S,E	ASSESS MISSILE IMPACT	Given FOG-M system and real-time and recorded video of missile impact.			
12.01	N	I	STATE METHODS FOR ASSESSING TARGET DAMAGE	None.	State methods correctly.		Real time video, recorded video, subject missile, and reconnaissance missile.
12.01.01	N	I,S	STATE EVIDENCE FOR TARGET DAMAGE	Given a particular damage assessment method.	State common elements of evidence indicating tank damage.		Common elements of evidence indicating tank damage.
12.02	Y	I	RECORD SEEKER VIDEO FROM MISSILE	Given the FOG-M system, video recorder and video tape.	Load tape and operate video recorder at 100% level.	Operate video recorder to record. Load tape.	Procedures to operate video recorder to recorder, and procedures to load tape.
12.02.01	Y	I	OPERATE VIDEO RECORDER IN RECORD MODE	Given the FOG-M system.	Perform correctly.		
12.02.01.01	N	I	STATE PROCEDURES TO OPERATE VIDEO RECORDER IN RECORD MODE	None.	State steps to record in correct order. State how to load tape.		Procedure to record seeker video, location of recorder controls/switches.
12.03	Y	I,S,E	VIEW RECORDED SEEKER VIDEO AND ASSESS TARGET DAMAGE	Given the FOG-M system and a videotape of a reconnaissance missile recording of the subject missile impact.	Assess disabling effect correctly 90% of the time. Expert assesses correctly 100% of the time.	Assess the probability that the missile disabled the target, operate video playback.	Characteristics of disabled target, procedures to use playback features.
12.03.02	Y	I	OPERATE VIDEO RECORDER IN PLAYBACK MODE	Given FOG-M video recorder, tape, and video display.	Operate all controls relevant to playback.	Operate the video recorder.	Procedures to operate video reocrder in playback mode.

NUMBER	ET	SKILL LEVEL	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
12.03.02.01	N	I	STATE PROCEDURES TO OPERATE VIDEO RECORDER IN PLAYBACK MODE	Given video recorder/player.	State all relevant controls and their function.		Play, stop, freeze, fast forward, reverse, scan.
12.04	Y	I,S,E	ASSESS SEEKER VIDEO OF IMPACT IN REAL TIME	Given FOG-M system, one viewing of missile impact.	Make correct disabled/nondisabled judgment 75% of the time. Expert assesses correctly 100% of the time.	Real-time determination of probability of disabling target.	Vulnerable points of targets.
12.05	Y	I,S,E	VIEW TARGET AREA VIA SEEKER FROM OTHER MISSILE (MULTI-MISSILE SALVO)	Given FOG-M system and multi-missile video.	Perform correctly.		
12.05.01	Y	I,S,E	SCAN TARGET AREA FOR RESULTS OF PRIOR MISSILE IMPACT (MULTI-MISSILE SALVO)	Given multi-missile video.	Find impact results 100% of the time within 5 minutes. Expert gathers additional information.	Multi-missile salvo navigation and control.	
12.06	N	I	MISSION DEBRIEFING	None.	Perform correctly.		
12.06.01	N	I	DELIVER VIDEO TAPES OF MISSION TO PROPER COMMAND AUTHORITY	None.	State procedures correctly.		
12.06.02	N	I,S,E	PROVIDE ORAL MISSION REPORT	Given results of impact assessment.	Perform correctly. Expert delivers a more integrated report.		

NUMBER	ET	SKILL LEVEL	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
12.06.03	N	I,S,E	PROVIDE WRITTEN MISSION REPORT	Given results of impact assessment.	Perform correctly. Expert provides a more integrated written report.		
13.	N	I	DEPART THE LAUNCH SITE	Given the FOG-M system.	Begin departure movement within 10 minutes of command to move.		
13.01	N	I	REPLACE GUNNER'S CONSOLE IN HMMWV	Given the FOG-M system.	Perform correctly.		
13.01.01	N	I	PLACE GUNNER'S CONSOLE IN HMMWV	Given the FOG-M system.	Perform correctly.		
13.01.02	N	I	SECURE GUNNER'S CONSOLE IN HMMWV MOUNT	Given the FOG-M system.	Perform correctly.	Install gunner's console into HMMWV mount.	Procedure for removing/replacing gunner's console.
13.01.03	N	I	RECOVER/STOW THE REMOTE POWER CABLE	Given the FOG-M system.	Perform correctly.	Store gunner's console connecting cable, replace connector covers.	Procedure for stowing gunner's console connector cables.
13.02	N	I	SECURE LAUNCHER TO HMMWV	Given the FOG-M system.	Perform correctly.		
13.02.01	N	I	LOAD LAUNCHER INTO HMMWV LAUNCHER-STORAGE COMPARTMENT	Given the FOG-M system.	Perform correctly.	Install launcher in HMMWV.	
13.02.03	N	I	REMOVE CAMOUFLAGE MATERIAL FROM LAUNCHER	Given the FOG-M system.	Perform correctly.	Remove/stow camouglage material.	Procedure for removing/stowing camouflage material.

NUMBER	ET	SKILL LEVEL	TITLE	CONDITIONS	STANDARDS	SKILLS	KNOWLEDGES
13.02.04	N	I	RETRACT HYDRAULIC ARMS AND GUIDE LAUNCHER INTO STOWAGE COMPARTMENT	Given the FOG-M sytem.	Perform correclty.	Stow launcher on HMMWV.	Procedure for loading launcher characteristics of normal stowed FOG-M launcher.
13.03	N	I	DEPART LAUNCH SITE IN HMMWV	Given the FOG-M system.	Perform correctly.		
14.	Y	I,S,E	PERFORM A FULL FOG-M MISSION	Given the FOG-M system. Perform under all types of obscuration and reasonable flight weather conditions.	Fly azimuth, coordinate, and pre-planned missions and hit targets at 90% kill rate with 0% hits on friendlies.		